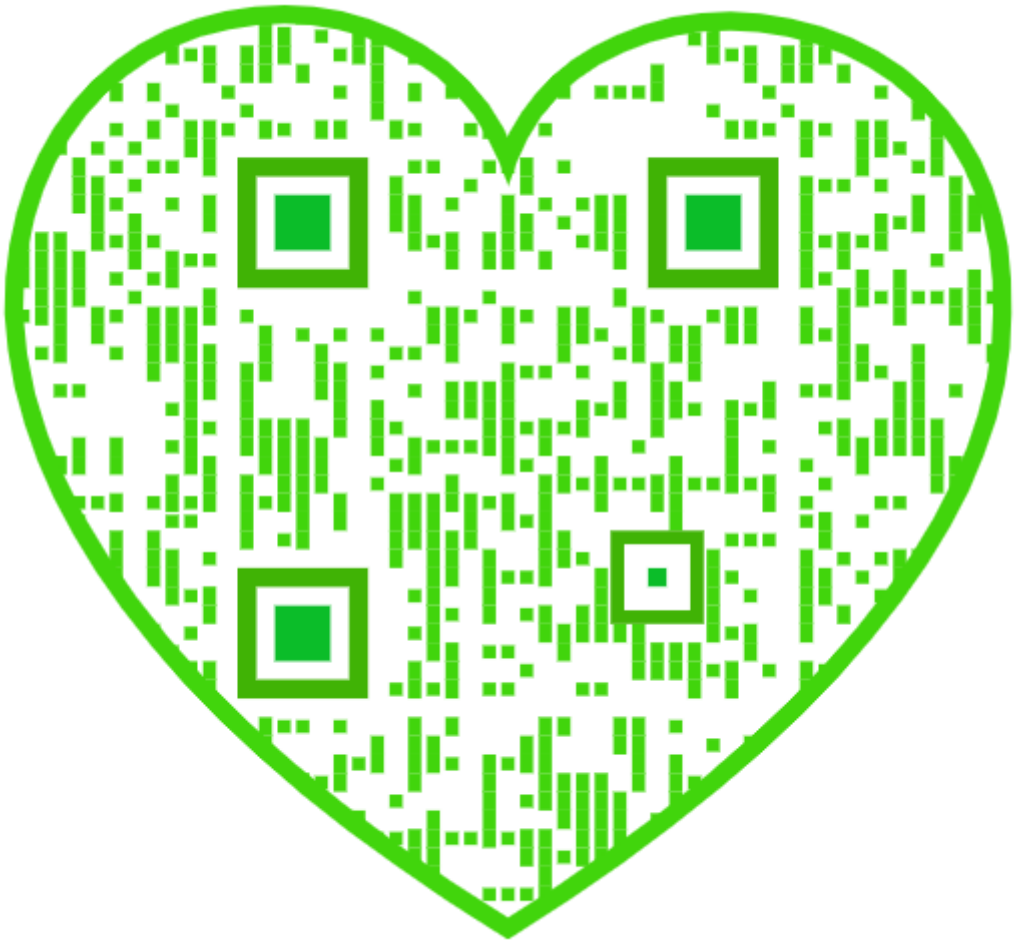


Stephens' Book of the Farm

Wherefore come on, O young husbandman!
Learn the culture proper to each kind.

VIRGIL.

Stephens' Book of the Farm

Dealing exhaustively
with every Branch of Agriculture

FIFTH EDITION

REVISED AND LARGELY REWRITTEN BY

JAMES MACDONALD, F.R.S.E.

SECRETARY OF THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

AUTHOR OF
'FOOD FROM THE FAR WEST,' 'POLLED CATTLE' AND 'HEREFORD CATTLE' (JOINTLY),
'SYSTEMS OF LAND TENURE,' ETC., ETC.

IN THREE VOLUMES

VOLUME III.—FARM LIVE STOCK

WILLIAM BLACKWOOD AND SONS
EDINBURGH AND LONDON

CONTENTS OF VOLUME III.

FARM LIVE STOCK.

HORSES.

	PAGE
Farm live stock	1
Breeds of horses	2
Breeds of cattle	3
Wild white cattle	4
Cadzow Park wild white cattle	4
Chillingham Park wild white cattle	5
Other wild white herds	6
Modern British cattle	6
Breeds of sheep	7
Goats	8
Breeds of swine	8
The Shire Horse	9
Origin	9
Shire Horse Society	9
Veterinary inspection	9
Distribution	9
Ground for breeding	9
Horse-breeding societies	10
Fees and "retainers"	10
Value of pedigree mares	10
Public and private prices	10
Mating	11
Peculiarities of stallions	11
Foaling	11
Forcing young stock	11
Characteristics—	
Colour	11
Size	11
Dimensions and weight	11
Form	12
Type	12
Legs and pasterns	13
Action	13
Feet	13
A typical Shire	13
Hair	14
English and Scottish notions	14
Feeding and management—	
Bringing out Shires for show	14
Rearing foals	14
Young horses	15
Attention to hair	15
Attention to feet	15
Grooming and handling	15
Adult animals	15
Clydesdale Horses	16
Origin	16
The Clydesdale in peace and war	16
Early improvement	16
Spreading of the breed	18
Galloway horses	18
The breed in the Stewartry	18
The breed in Kintyre	19
The breed in Cumberland	19
The breed in Aberdeenshire	20
The Clydesdale Horse Society	20
Infusion of Shire blood	20
Admission to Stud-book	20
Characteristics—	
Ancient types	21
Favourite type in 1850-1880	21
Prince of Wales	21
Darnley	22
Stock of Prince of Wales and Darnley	22
Measurements of Clydesdales—	
Sir Everard	22
Baron's Pride	22
Hiawatha	23
Royal Favourite	23
Measurement of mares	23
Features of the modern Clydesdale	23
Markets for Clydesdales—	
Export trade	23
Export certificates	23
Home market	24
Clydesdale sales from 1876 to 1908	24
Management of Clydesdale studs	25
Brood mares	25
Foaling	26
Care of foals	27
Putting mares dry	27
Other classes	27
Management of show stock	28
The Suffolk Horse	28
Historical	28
Characteristics—	
Colour	29

Form 29
Measurements 30
Action and handiness . . 30
Docility and longevity . . 30
The Suffolk Horse Society . . 30
Foreign trade 31
Leading shows 31
Management 31
Brood mares 31
The foal 31
Service 32
Food and care in winter . . 32
Stallions 32

The Cleveland Bay . . . 32
Origin 32
Characteristics 33
Value for crossing . . . 33
The Yorkshire Coach-horse . . 33
Characteristics 34
Management 34

The Thoroughbred Horse . . 34
Thoroughbreds for hunter breeding 35
Forcing young stock . . . 35
Character 35

The Hunter 36
Type 36
Method of breeding . . . 36
Scarcity of mares . . . 36
Irish hunters 36
Management of hunters . . 37
Winter treatment . . . 37
"Making" hunters . . . 37

The Hackney Horse . . . 37
Historical 38
Practice of breeding . . . 38
Characteristics—
Type 39
Height 39
Colour 39
Action 39
For harness and saddle . . 39
Soundness 40
Alterations in form . . . 40
Management of Hackneys . . 40
Buildings 40
The brood mare . . . 41
Weaning 41
Young stock 41
Stallions 41

PONIES.

English and Irish Ponies . . . 41
Pony type 41
Points in pony breeding . . . 42
Hackney and Harness Ponies . . 42
The Polo Pony 43
The Dartmoor Pony . . . 44
The Exmoor Pony 44
The New Forest Pony . . . 44
The Fell Pony 45
The Welsh Pony 45
The Connemara Pony . . . 46
Management of ponies—
Size 47
Wintering hill ponies . . 47
Young cobs 47
Foals 47
Ponies on rough pasture . . 47
Training for shows . . . 48
Limitation of weight of shoes . 48

Highland Ponies 48
Origin 48
Galloway ponies 48
Resuscitation of Highland ponies 48
Points of Highland ponies . . 48
Early studs 49
The Atholl ponies . . . 50
Inverness-shire ponies . . . 51
Ross-shire ponies 51
Fell and Arab crosses . . . 52
Island ponies 53
Mull ponies 53
Skye ponies 53
Uist ponies 53
Rum ponies 53
Experiments with Highland ponies 54
Professor Ewart's experiments . 54
The Celtic pony . . . 54
Management 54

Shetland Ponies 54
Purity of Shetland ponies . . 55
A Norwegian cross . . . 55
A mustang stallion tried . . 55
Early description of breed . . 55
The modern type 56
Ponies in the mines . . 56
The Bressay stud 56
Pony management on crofts . 57
Management in the Bressay stud 57
Points of the breed . . 57
Distribution 57
Male ponies for mines . . . 58
"Sheltie" 58
Management 58
The pit ponies 59

The Ass and the Mule . . 59
Varieties of the ass . . . 59
Uses of donkeys 59
Longevity of the ass . . . 60
Mule breeding 60
Donkeys and mule breeding . 61
Foreign breeds of horses . . . 61

POLLED BREEDS OF CATTLE.

Aberdeen-Angus Cattle . . 62
Origin 62
Early improvement . . . 62
Mr Hugh Watson . . . 62
Mr Wm. M'Combie . . . 62
Sir George Macpherson Grant . 63
Early show successes . 63

Characteristics of the breed—
Record as beef-producers . . 63
Reputation in America . . 64
Records in fat stock shows . 64
Carcase competitions . . 64
Weights 65
Prepotency of the breed . . 65
Influence of the breed in England 65
Early maturity 65
Prices 65
Points of the breed . . . 66
Present position of the breed . 66
In Canada and United States . 66
In other countries . . . 66
Management of herds . . . 67
Ballindalloch herd . . . 68
Pictstonhill herd . . . 68
Mulben herd 69
Spott and Inverquharity herds 70
Dr Clement Stephenson's herd . 70
Preston Hall herd . . . 70
An Irish herd 71

Galloway Cattle 71
Early history 71
Early export to England . . 72
Origin 72
Improvement of the breed . . 72
Herd-books 73
Characteristics—
Milking properties . . 74
Galloway beef 74
Weights 74
Hardiness 74
Colour 75
For crossing 75
Blue-greys 75
Points of the breed . . . 76
Management in Galloway herds . 76
Chapelton herd . . . 76
Castlemilk herd . . . 76
Broomfield herd . . . 77

Red Polled Cattle . . . 78
Origin 78
The improved Red Poll . . 78
Establishing a herd-book . . 78
Standard description . . . 79
The modern types . . . 79
Colour 79
Red Polls in the showyard . . 79
Locality 80
Weights 80
Milk yields 80
Management of Red Polls . . 80
Eldo House herd . . . 80
The Honingham herd . . 80
Acton Reynold herd . . . 81
Combination of beef and milk . 81

HORNED BREEDS OF CATTLE.

Shorthorn Cattle 82
Origin of the breed . . . 82
Early improvers 82
The brothers Colling . . 83
Captain Barclay's pioneer work 83
Booth cattle 83
Bates cattle 84
Later improvers 84
Cruickshank Shorthorns . . 84
The ideal Shorthorn . . . 85
Mr Thornton's ideal Shorthorn . 85
Attributes of the breed . . 86
Beef-production . . 86
For crossing purposes . . 87
Milking properties . . 88
Shorthorn Society . . 89
Herd-book 89
Exports of Shorthorns . . . 89
Management in Shorthorn herds . 89
In Scottish herds . . . 89-91
In English herds . . . 91, 92
In Irish herds 93
Management in dairy herds . . 93

The Lincolnshire Red Shorthorn 94
Origin 94
Early improvement . . . 94
Later improvement . . . 94
Herd-book 94
Characteristics—
Description 95
Aims of breeders . . . 95
Robustness of constitution . 95
Flesh-bearing qualities . . 95
Type 95
Colour 95
Weights 95
Milking qualities . . . 96
The Burton herd . . . 96
Management 96

Hereford Cattle 97
Origin 97
Characteristics—
Uniformity of type . . 97
Colour of Herefords . . . 98
General appearance . . . 98
Standard description . . 98
Constitution 98
Freedom from tuberculosis . 98
Milking qualities . . . 99
A milking herd . . . 99
Weights 99
For crossing 99
In the showyard 99
Management 99
A milking herd . . . 100
In the Montford herd . . 100

Devon Cattle 101
Early history 101
The Quartly herd . . . 101
The modern Devon . . . 102
Appearance 102
The milking type . . . 103
Weights 103

Management of Devons . . 104
Mr Chick's herd . . . 104
Mr Huxtable's herd . . . 104
Mr Tribble's herd . . . 104

South Devon Cattle . . . 105
Early history 105
The Herd-book Society . . 105
Locality 105
Description 106
Points of excellence . . . 106
Recent improvement . . . 106
The South Devons abroad . . 106
Weights 106
Milking qualities 107
Management of South Devons . 107
Mr W. J. Crossing's herd . . 107
Messrs Whitley's herd . . 107
Mr B. Luscombe's herd . . 107
Messrs Butland's herd . . 108

Sussex Cattle 108
History 108
Early aims 108
Locality 108
Standard description . . . 108
Weights and early maturity . 109
Sussex bulls for crossing . . 110
Sussex cattle abroad . . . 110
Management of Sussex cattle . 110
Lord Winterton's herd . . 110
Mr Steven Agate's herd . . 110
Mr Hubble's herd . . . 110

Ayrshire Cattle 111
Historical 111
Early ideals 111
Points of the breed . . . 111
Type similar for 100 years . . 112
Infusion of strange blood . . 113
Useful properties—
Milking properties all-important 113
Milk records 113
Milk yields 113
Beef-production . . . 114
Weights 114
Management of Ayrshire herds . 114
Milk-selling herds . . . 114
Cheese and butter herds . . 115
Stewartry customs . . . 115
The "Bowing" system . . 115

Highland Cattle 116
Origin 116
Characteristics 116
Points of the breed . . . 117
Early improvement . . . 118
Size and early maturity . 119
For crossing purposes . . . 119
Temper of cattle 119
Herd-book Society . . 119
Management of the breed . . 119
The Atholl fold . . . 120
Castle-Grant fold . . . 120

Welsh Black Cattle . . . 121
Historical 121
Characteristics 122
Hardiness 122
Rate of maturity and weights . 122
Grazing properties . . . 122
Quality of beef 122
Milking properties . . . 123
Need for pioneer improvers . . 123
Improvement required . . 123
Risk in introducing out-crosses . 124
Selection preferable to crossing . 124
Management of Welsh cattle . 124

Kerry and Dexter Cattle . 125
Origin of the Kerry . . . 125
Headquarters 125
Kerries as emigrants . . . 125
The typical Kerry . . . 126
Origin of the Dexter . . . 126
The name of Dexter . . . 126
Type of the Dexter . . . 127
Characteristics 127
Improvement 127
Weights and measurements . 127
Milking properties . . . 128
As beef-producers . . . 128
For crossing purposes . . 128
Colour 128
Management 128

Jersey Cattle 129
Origin 129
Introduction into England . . 129
Improvement of the breed . . 129
Characteristics 129
Scale of points 129
Weight 130
English improvers . . . 130
English Jersey Cattle Society . 130
Milk and butter tests . . . 130
Merits of Jersey cows . . . 131
Management of Jersey cattle . 131
Example rations . . . 132

Guernsey Cattle 132
Origin 132
Characteristics 133
Scale of points 133
Milking properties . . 133
Management of Guernseys . . 134
Guernsey Herd-book . . . 134

The Dexter-Shorthorn . 135
Origin 135
Weights and measurements . . 136

Other breeds of cattle . . 136
Long-horned cattle . . 136
Orkney and Shetland cattle . 136
Foreign breeds of cattle . . 137
Polled Durhams in United States 137
Polled Herefords . . 137

SHEEP.

Long-Wool Breeds of Sheep.

The Leicester Sheep . . . 138
Bakewell's influence . . . 138
Locality 139
Characteristics 139
Clip and weight 139
Management of Leicesters . . 139
Mr T. H. Hutchinson's flock . . 139
Gainford Hall flock . . . 140
Border Leicesters . . . 140
Origin—Bakewell's improvements 141
Messrs Culley's flocks . . . 141
Other early improvers . . . 141
The Mertoun flock . . . 142
Other noted breeders . . . 143
Characteristics . . . 143
Value for crossing . . . 144
Management of Border Leicesters 144
Leaston flock 144
Galalaw flock 145
Pictstonhill flock . . . 145
Oldhamstocks flock . . . 146
Deuchrie flock 146
Whittingehame flock . . 147
Preparing rams for sale . . 147
The Lincoln Long-wool . . 148
Noted early flocks . . . 148
Modern records 148
Characteristics 148
Clip and weight 149
Early maturity 149
Constitution 149
Foreign trade 149
Management of Lincoln flocks . 149
Cropwell Butler flock . . 149
Riby Grove flock . . . 150
Cotswold Sheep . . . 150
Origin 150
Improvement 150
Characteristics 151
Mutton and wool production . 151
Prices 151
Management of Cotswolds . 151
The Devon Long-wool . 152
Early history 152
Characteristics 152
Clip and weights 153
Management of Devon Long-wools 153
The South Devon . . . 153
Origin 153
Characteristics 154
Description 154
Weight and clip 154
Management of South Devon sheep 154
Wensleydale Sheep . . . 154
Characteristics—
Appearance 155
For crossing 155
Clip and weight 155
Management 155
Kent or Romney Marsh Sheep . 156
Characteristics 156
Points 156
Clip 156
Weights 156
Management 157
Roscommon Sheep . . . 157
Improvement of the breed . 157
Characteristics . . . 157
Fleece 158
Management 158
Half-Bred Sheep . . . 158
Founding of the breed . . 158
Two classes of Half-breds . 159
Distribution of the breed . . 159
Early lambs from Half-bred ewes 159
Three-parts-bred lambs 160
Increasing popularity . . 160
Characteristics—
Appearance 160
Weights and feeding qualities . 160
Clip 160
Sale centres 160
Management of Half-bred flocks 161

Short-Wool and Down Breeds of Sheep.

The Southdown . . 162
Early improvers . 162
Characteristics . . 162
Description . . . 162
Disqualifications . . 162
Types 163
Dead-weight . . 163
Weight and value of fleece . . 163
For crossing 163
Management 163
The Shropshire . . 164
Origin 164
Early breeders . . . 164
Early types 164
Modern types . . . 165
Merits of the breed . . 165
Prolific character . . 165
Progress of the breed . . 165
Weights . . . 165
For crossing 165
Management of Shropshire flocks 165
Mr T. S. Minton's flock 166
Mr T. A. Buttar's flock . 166
System of ear-marking . 166
Mating rams and ewes . 167
Treatment of ewes 168
Lambing season . 168
Feeding of lambs . . 168
Pulped food for sheep 169
Feeding-boxes . 169
Young rams . . . 169
Ewe lambs 169
Prevention of foot-rot . . 170
Solution for foot-rot . 170
The Hampshire Down . . 170
Characteristics . . . 170

Early maturity 170
Weight of lambs 170
Examples of precocity . . . 171
Constitution 171
Breeding from lambs . . . 171
Fleece 172
Description 172
Shepherds' competitions . . 172
Management of Hampshire flocks 172
The Oxford Down 173
Early efforts 174
Characteristics 174
Fleece 174
Change in type 174
Points in breeding . . . 174
Location 174
For crossing 174
Show classification . . . 175
Management 175
Mr Treadwell's flock . . 175
Maisey Hampton flock . . 176
The Suffolk 176
Origin 176
Characteristics 176
Scale of points 177
Prolificacy 177
Produce of mutton . . . 177
For crossing 177
Management of Suffolk flocks . 177
Mr Herbert E. Smith's flock . 177
The Playford flock . . . 178
The Ryeland 178
Appearance and weight . . 178
Fleece 178
Management 178
The Dorset Down . . . 178
Early improvement . . . 179
Characteristics 179
Early maturity and weight . . 179
Management 179
The Dorset or Somerset Horn Sheep 180
Characteristics 180
Fecundity 180
Early maturity 180
For crossing 181
The Somerset Horn sheep . . 181
Clip 181
Management 181
Mr Samuel Kidner's system . 181
Mr F. J. Merson's flock . . 182
Radnor Sheep 182
Characteristics 182
Management 182

Mountain and Moorland Breeds of Sheep.

Blackface Sheep 183
Distribution of breed . . . 183
Characteristics 183
A typical Blackface sheep . . 184
Weights 184
Prices of Blackface sheep . . 184
Prices of wool 184
Management 185
Dipping 185
Markets 185
Qualifications of a shepherd . 185
Glenbuck Blackfaces . . 186
Blackface ram-breeding . . 186
The Overshiels system . . 187
Messrs Cadzow's system . . 187
The Woolfords system . . 188
Mr M. P. Fraser's system . 189
Cheviot Sheep 189
Origin 189
Early improvement . . . 190
Characteristics 190
Appearance 190
Wool 191
Crossing purposes . . . 191
Improvers of Cheviots . . . 191
Flock-book 192
Management in Cheviot flocks . 192
Newton flock 192
Mowhaugh flock . . . 193
Alton flock 193
Dalchork, Lairg . . . 194
The Exmoor Horn Sheep . . 194
Characteristics 194
Management 195
The Dartmoor Sheep . . . 195
Characteristics 195
Management 196
The Lonk Sheep 196
Origin 196
Locality 196
Weight 196
Characteristics 197
Management 197
Herdwick Sheep 197
Characteristics 197
Management 198
Welsh Sheep 198
Characteristics 198
Dead-weight 199
Crossing experiments . . . 199
Management 199
Kerry Hill (Wales) Sheep . . 200
Characteristics 200
Official description . . . 200
Management 200
Weights 201
Derbyshire Gritstone Sheep . 201
Improvement 201
Characteristics 201
Weight 202
Scale of points 202
Management 202
The Clun Sheep 203
Characteristics 203
Management 203
Other breeds of sheep . . 203
The Norfolk 203
Wiltshire sheep 204
Masham sheep 204

Penistone sheep . . . 204
Shetland sheep 204
Other types 205
Iceland sheep 205
St Kilda sheep 205
Swaledale sheep . . . 205
Foreign breeds of sheep . . . 205
Merino sheep 205

GOATS.

Habitat of goats 206
Goats as milkers 206
Goats' milk 207
Varieties of goats 207
Swiss goats 208
Selection of goats 208
Management of goats . . . 208
Rearing kids 209
Liberal feeding required . . . 209
Objections to goats 209

SWINE AND THEIR MANAGEMENT.

Large White pigs 210
Middle White pigs 211
Large White Ulster pig . . . 212
The Berkshire pig 213
Large Black pigs 214
The Tamworth pig 214
Lincolnshire Curly-coated pigs . 215
Small breeds of pigs . . . 216
The Small White pig . . . 216
Small black pigs 216
Other types of pigs . . . 217
The Black Dorset . . . 217
The Improved Dorset . . . 217
The Hampshire pig . . . 217
The Gloucester Spotted pig . . 217
Management of pigs . . . 217
Farrowing 217
Period of gestation . . 217
Symptoms of farrowing . . 217
Bedding for young pigs . . 218
Treatment of sow and produce . 218
The after-birth . . . 218
Assistance in farrowing . . 218
Pigs biting sow's udder . . 218
Weaning pigs 219
Housing brood-sows . . . 219
Prolificacy in swine . . . 219
Seasons for farrowing . . . 219
Early maturity in pigs . . 220
Attention to pig-rearing . . 220
Winter farrowing risky . . 220
Rearing and feeding pigs . . 220
Feeding the sow and her litter . 220
Weaning pigs 221
Castrating pigs 221
Feeding young pigs . . . 221
Feeding old pigs unprofitable . . 222
Exercise for feeding-pigs . . 223
Keep pigs clean . . . 223
Pigs in cattle-courts . . . 223
Rest for feeding-pigs . . 224
Bedding for pigs . . . 224
Nomenclature of pigs . . . 224

THE PRINCIPLES OF STOCK-BREEDING.

Heredity 225
"Variations" in breeding results . 225
Transmission of acquired characters 226
Other breeding problems . . 227
Telegony 227
Mental impression . . . 227
Controlling sex 227
Systems of breeding . . . 228
Cross-breeding 228
Grading 228
Line-breeding 229
In-and-in breeding . . . 229
The value of in-bred families . 229
In-and-in breeding in pioneer herds 230
Mendel's laws in stock-breeding . 231
Mendel and his work . . . 231
Mendelism explained . . . 232
Periods of gestation in farm stock . 236

POULTRY.

Poultry-rearing 236
New-laid eggs 236
Table poultry 236
Pure breeds 237
Classification 237
Laying varieties—
Minorcas 237
Leghorns 237
Andalusians 238
Houdans 238
Anconas 238
Campines 238
Hamburgs 238
Scotch Greys 238
Table breeds—
Dorkings 238
Indian Game 238
Old English Game . . . 238
Sussex 238
General purpose breeds—
Orpingtons . . . 238
Wyandottes . . . 239
Plymouth Rocks . . . 239
Langshans 239
Fancy breeds 239
Cross-bred poultry 239
Advantages of pure breeds . . 240
Ducks 240
Geese 245
Turkeys 245
Pure and cross stocks . . . 245
Housing poultry 245
Fixed houses 246
Cleanliness 246
Ventilation 246
Movable houses 246

Feeding poultry . . . 247
Hand-feeding for laying . . 247
Fattening poultry . . . 248
Feeding chickens 248
General points in poultry-feeding 249
Incubation 249
Use of incubators . . . 249
Testing eggs 250
Artificial and natural rearing . 250
Marketing poultry 251
Winter eggs 251
Early moulting 251
Laying competitions . . . 251
Co-operative marketing . . 252
Preserving eggs 252
Use of waterglass . . . 252
Lime-water 252
Cold storage 253
Essential conditions in storing eggs 253
Diseases 253
Infectious diseases . . . 253
Vermin 253
Bird-lice 253
Mites 254
Gapes 254
Scaly leg 254
White comb 254
Roup 254
Liver disease 255
Tuberculosis 255
Vices in poultry—
Egg-eating 256
Feather-eating 256

BEE-KEEPING.

Bee-keeping as a farm industry . 257
Clover for bees 257
Bees *v.* Shorthorns 257
Produce of hives 257
Commencing bee-keeping . . 257
Improved practice . . . 257
Cheap and improved appliances . 257
Marketing honey 258
Knowledge necessary . . . 258
Principles of bee-keeping . . 258
Hives 258
Appliances for special conditions 259
Study surroundings . . . 259
Caution in practice—
Obtaining stocks 259
Bee-fever 259
Appliances 259
Hat-veil 259
Smoker 259
Hives 259
Sections 259
Crates 260
Comb-foundations . . . 260
Other appliances 260
Honey extractor 260
Management—preliminary—
Driving bees . . . 260
New swarms 260
Another plan 260
Rapid increase of stocks . . 260
Purchasing swarms . . . 260
Collecting driven bees . . . 261
Wintering—
Secret of success 261
Preparing for winter . . . 261
Weak hives 261
Bees not shut in 261
Experiments 261
Spring treatment—
Breeding resumed . . 261
Supplementing the winter food . 261
Liquid food 262
Stimulating stocks . . . 262
Continuous treatment . . . 262
Summer treatment—
Working for honey . . . 262
Working for increase of stocks . 262
Extracted or comb honey . 262
The writer's practice . . 262
Controlling swarming . . 263
Securing well-ripened honey . 263
Produce 263
Autumn management—
Heather honey . . 263
After honey harvest . . . 263
Bees plundering 264
Food for bees—
Liquid food for bees . . . 264
Sugar-cake for bees in winter . 264
Spring food 264

SHEEP-DOGS.

Origin of collies 264
Varieties of collies 265
Bearded collies 265
Smooth- and rough-coated collies. 265
Old English sheep-dogs . 266
Other kinds of collies . 266
Training dogs—
Bad training of dogs . . 266
Judicious training . . 267
Well-trained dogs . . 267
Skill in training . . . 267
Sagacity of the collie . . . 268
Dog trials 268

VARIETIES OF FOOD.

Milk 269
Wheat 269
Damaged wheat for stock . . 269
Bran 270
Barley 270
Malt 270
Rothamsted experiments . . 270
Special properties of malt . . 271
Malt-combs 271
As manure 271
Bere and rye 271

Brewers' and distillers' grains . 271
Dried *v.* wet grains . . . 272
Other distillery food . . . 272
Oats 272
Bruising oats 272
Nutriment in oatmeal . . . 272
Indian corn 272
Buckwheat 272
Rice 273
Rice-meal 273
Dari or Durra 273
Beans, peas, and lentils . . 273
Vegetable casein 273
Preparing beans as food . . 274
Soy beans 274
Peas for sheep 274
Poisonous beans 274
Lupin 274
Linseed 274
Preparing and using, as food . 275
Boiling linseed 275
Growing flax for fibre and seed . 275
Linseed-cake 275
Storing linseed-cake . . . 275
Adulteration of cakes . . . 276
Rape-cake 276
Cotton-cake 276
Caution in using undecorticated cotton-cake 276
Uses of decorticated cotton-cake . 277
Preparing cotton-cake for feeding 277
Manurial value of cotton-cake . 277
Palm-nut meal 277
Cocoa-nut cake 277
Minor oilcakes 277
Poppy-cake 278
Locust or carob beans . . . 278
Molasses or treacle 278
Treacle for breeding stock . . 278
How treacle is used . . . 279
Turnips 279
Advantages of storing . . . 279
Variation in composition of . . 280
Sugar in roots 280
Excess of water in roots . . 280
Economising turnips . . . 280
Turnip-tops 281
Mangel-wurzel 281
Advantages of storing mangels . 281
Medium *v.* large roots . . . 281
Sugar-beet 281
Beet-root pulp 281
Carrots 282
Parsnips 282
Kohl-rabi 282
Cabbages 282
Thousand-headed kale . . . 282
Broccoli 282
Potatoes 282
Value of potatoes for cattle . . 282
Utilising diseased potatoes . . 282
Potatoes for horses . . . 283
Water with potatoes 283
Green rape 283
Furze, whins, or gorse . . . 283
Furze as winter food . . . 283
Preparing furze as food . . 283
How fed to stock 283
Grasses and clovers 284
Composition of grasses and clovers at different stages of growth . 284
Hay—
Loss in hay-making . . 286
Damaged hay . . . 286
Straw 286
Straw-chaff 287
Preparing and storing straw-chaff 287
Compound cakes and meals . . 287
Condimental foods 288
Vetches 288
How vetches are fed to stock 288
Green maize 288
Sorghum 289
Lucerne 289
Sainfoin 289
Prickly comfrey 289
Sugar 289
Fish products as animal food . . 290
Composition of foods . . . 290

ANIMAL NUTRITION.

Constituents of foods . . 291
The functions of food . . 291
Digestion 292
Metabolism 296
Water requirements of animals . 296
Energy value of foods . . . 297
Energy consumed in digestion . 298
Other internal work . . . 298
Foods for maintenance and production 299
Albuminoid ratios . . . 299
Food requirements of animals . . 301
The young animal . . . 302
The adult animal 302
The working animal . . . 302
The fattening animal . . . 302
The milking cow 303

THE MANURIAL VALUE OF FOODS.

Manurial value of foods . . . 303
Urine 304
Solid excreta 304
Proportion of food assimilated and voided 304
Lawes and Gilbert's tables . 304-308
Theoretical and realised manure values 310
Unexhausted value of consumed food 310
Voelcker and Hall's tables . . 311

TREATMENT OF FARM-HORSES.

Watering horses 313
Morning feed 313
Mid-day care of horses . . . 314
Hours of work 314
Work expected of horses . . . 314
Evening care of horses . . . 314
Grooming horses 314
Brushing and combing . . . 315
Rubbing wet or heated horses . . 315
Water-brush 315
Exercise for horses 315
Breeding horses 315
Wintering young horses . . . 315
Housing in cold districts . . 315
Handling young horses . . . 315
Intelligence of horses . . . 315
Feeding horses 316
Food for horses 316
Food requirements of horses . 316
Ration for idle horses . . 316
Additional food for work . . 317
Pace and food requirement . 317
Force exerted by horses . . 317
Rations for degrees of work . 317
Winter feeding of horses . . 318
Preparing food for horses . . 318
Mashes for horses . . . 318
Oats for horses 318
Substitutes for oats . . . 318
A group of rations . . . 319
Roots for horses . . . 319
Carrots and parsnips . . 319
Furze for horses . . . 319
Feeding young horses . . 320
Rations for town horses . . 320
Riding and driving horses 320
Quantity of food . . . 321
Bulk of food 321
Frequency of feeding . . 321
Care of horses in summer—
Pasturing work-horses . . 321
Soiling horses 321
Pasturing young horses . . 322
Peculiarities of the horse in grazing 322
Horses injured by green food . 322
Littering horses—
Straw as litter 322
Peat-moss litter 322
Other varieties of litter . . 323
Exercise for horses 323
Rest for horses 323
Washing horses' legs . . . 323
Shoeing horses 323
Clipping and singeing . . . 323
Injurious to clip legs of horses . 324
Protection to skin from wet . . 324
Method in stable management . 324
Foaling season 324
Insurance against foaling risks . 324
Abortion in mares . . . 324
Care of brood mares . . . 325
Watching mares at foaling . . 325
Symptoms of foaling . . . 325
Assistance in foaling . . 325
Difficult foaling 325
Reviving an exhausted mare . 326
Support to mare's belly . . 326
Mare's udder 326
After foaling 326
Cleansing 326
After-straining 326
Attention to the foal . . . 326
Reviving weak foals . . . 326
Rearing foals 327
Troublesome mares . . . 327
Beginning the foal to suck . . 327
Nursing motherless foals . . 327
Rearing foals by hand . . . 327
Cow's milk for foals . . . 327
Bean-milk and cow's milk . . 327
Linseed, bean-meal, and milk . 328
Health of the foal . . 328
Housing mares and foals . 328
Working nurse-mares . . . 328
Weaning foals 328
Feeding foals at weaning-time . 329
Attention to the mare at weaning 329
The mating season 329
Number of mares to one stallion . 329
Nomenclature of horses . . 330
Names suitable for farm-horses . 330

MANAGEMENT OF COWS AND CALVES.

Calving season 330
Symptoms of pregnancy . . 330
Reckoning time of calving . . 331
Gestation 331
Prolapse of the vagina . . . 331
Feeding in-calf cows . . . 331
Critical period in pregnancy . 331
Calving—
Symptoms of calving . . . 331
Attendance in calving . . . 331
Preparation for calving . . 331
The calf 332
Navel-string 332
Reviving calves 332
Extracting a dead calf . . . 332
Refreshing the cow . . . 333
Immediate milking . . . 333
Licking and rubbing calves . . 333
Bulling—
Coming in "season" . . . 333
Too early bulling unwise . . 333
Leading cows 333
Abortion 334
Sporadic abortion—
Causes of 334
Ergot causing abortion . . 334
Prevention 334
Preventing recurrence of . . 334

Epizootic abortion . . . 334
Causes of 335
Treatment 335
Preventive treatment . . 335
Board of Agriculture inquiry into epizootic abortion . . . 337
Microbe of cattle abortion . 337
Microbe of sheep abortion . 337
Methods of infection . 338
Immunisation of animals . . 338
Curative measures . . . 339
Milking cows 340
The udder 340
Milking period 340
Hours of milking . . . 340
Hours of milking and butter-fat . 340
Milk-pails 340
Cows holding back milk . . 341
The milking side 341
The operation of milking . . 341
An improved system of milking . 342
Milking-machines . . . 342
Spaying cows 343
Feeding of cows 344
Dairy herds 344
Regulating food by milk yield . 344
Typical rations 344
Rations for dry cows . . 345
Dairy cows in summer . . 346
Feeding dry and breeding cows 346
Ventilation—effect of temperature on milk-yield . . . 346
Experiments with cows . . 346
General conclusions . . . 348
Calf-rearing 348
Aversion of farmers to calf-rearing 348
Calf-rearing on large farms . . 349
Deficiency of store cattle . . 349
Home-breeding the remedy . . 349
Rear more calves 349
Breed longer from cows . . 349
Breeding from heifers . . . 349
Are calves nuisances? . . . 350
Milk substitutes 350
Rearing or selling calves . . 350
Housing calves 350
Calf-crib 351
Care in letting out calves . . 351
Calf's first food . . . 351
Composition of biestings . . 351
Feeding calves—
Reform in calf-feeding . . 351
Calf-feeding in pure-bred herds 352
In mixed-bred herds . . 352
Suckling and hand-rearing . 352
Prevalent methods . . . 352
Separated milk for calves . . 352
Artificial food for calves . . 352
Preparing food for calves . . 353
Quantities of milk for calves . 353
Allowances of other foods . 353
North of England rations . . 353
General notes—
Feeding calves for veal . . 353
Danger of gorging calves . . 354
Weaning calves 354
Setoning 354
Castrating 354

MANAGEMENT OF STORE AND FATTENING CATTLE.

Preparation of food for cattle . 355
Washing roots 355
Frozen roots 355
Cutting turnips 355
Pulping 355
Economy of pulping . . . 355
Preparing pulped mixtures . 356
Food-preparing compartment . 356
Cooking or steaming . . . 356
Bruising grain 357
Winter housing of store cattle . 357
Fresh air for cattle . . 357
Loss from exposure to bad weather 357
Economical rearing of cattle . 357
Houses for cattle in cold districts 358
Cattle-sheds in southern districts 358
Cattle-courts 358
Winter feeding of store cattle . . 358
Apportioning home-grown foods 358
Economise turnips . . . 359
Foods to be bought and sold . 359
Advantage in using home-grown food 359
Ages of store cattle . . . 359
Care in beginning winter feeding . 359
Turnips and straw for store cattle 360
Feeding hours 360
Kinds of roots for store cattle . 360
Roots, cake, meals, and fodder for store cattle 361
Southern systems of feeding store cattle 361
Pulped food for store cattle . 361
Proportions of pulped mixtures 362
Store cattle on pastures . . 362
Give the pasture a good start 362
Overgrowth of pastures injurious 362
Changing stock on pastures 363
Mixed stock on pastures 363
Fattening cattle in winter . 363
Early maturity . . . 363
Age for fattening 364
Cheaper meat from young animals 364
Lawes on profitable feeding . 364
Methods of fattening cattle . 364
What food is to be used? . 364
Feeding rations . . . 365
Balancing food properly . . 365
Scottish feeding customs . . 365
Daily allowance of turnips . 365
Feeding hours 365
Turnips or cake for breakfast? . 366

Allowance of cake and grain . 366
The pulping system . . . 366
Cattle-feeding in Aberdeenshire 366
Mr M'Combie's system . . 366
Cattle-feeding in Easter Ross . 367
Anthrax and imported food 368
A popular Scotch "blend" 368
Cattle-feeding in England . . 368
Roots and green food for feeding 368
Hereford examples . . . 368
Norfolk systems . . . 368
A Berkshire system . . . 369
Frequent feeding . . . 369
Mr M'Calmont's system . . 369
Potatoes for cattle . . 369
Oatmeal balls 369
Feeding without roots . 369
Winter feeding on fields . 370
Cattle-feeding in Ireland . . 370
Feeding on pastures . . 370
Concentrated food on pastures. 370
"Soiling" 370
Advantages of "soiling" . . 370
Disadvantages of "soiling" . 371
Utility of the system . . 371
Review of feeding experiments . 371
Increase in live-weight . . 372
Digestible matter per lb. of increase 372
Digestible albuminoids . . 372
Albuminoid ratio. . . . 372
Influence of age on feeding . . 372
Leguminous fodders . . 373

PREPARING CATTLE FOR SHOWS.

Improvement in show stock . . 373
Selecting show stock . . . 374
Good breeding essential . . . 374
Form and constitution . . . 374
Temperament 374
Proper age 374
Calf-rearing 374
Mixed feeding-cakes . . 375
Housing calves 375
Salt and chalk for calves. . . 375
Quantities of food and peculiarities of animals 375
Value of showyard honours . . 375
Exercising and handling . . . 375
Attention to animals' feet . . 376
Grooming 376
Increasing food with advancing age 376
Use of condiments 376

FLOCK MANAGEMENT.

Flock management 376
Lambing season 377
Lambing-pens 377
Hardiness of hill sheep . . 377
Lambing hospital . . . 377
Supplementary shelter. . . 377
Shepherd's hut 377
Assistance in lambing . . . 377
Inflammation after lambing . 378
Assisting lambs in feeding . 378
Cow's milk for lambs . . . 378
Mothering lambs 378
Stimulants for weak lambs . . 379
Carrying lambs 379
Cleaning ewes' udders . . . 379
The lambing period . . 379
After lambing—
Castration . . . 379
Docking 379
Risks from castration and docking 380
A preventive 380
Rig or chaser . . . 380
Look to the pastures . . 380
Shepherding on arable farms . 380
Shepherding hill sheep . . 380
Ailments among lambs . . 380
Ailments amongst ewes . . 381
Abortion among ewes . . . 381
Unripe roots and abortion . 381
Foot-rot and abortion . . 381
Twins and abortion . . . 381
Preventive measures . . 381
Sheep in summer and autumn 382
Ewes and lambs 382
Pasturing sheep on arable farms . 382
Summer fattening . . . 382
Store sheep in summer . . 382
Shifting sheep on pastures . 382
Water for sheep . . 382
Salt for sheep 383
Maggot-fly 383
Unclipped sheep falling . . 383
Pasturing sheep on hill-farms . 383
Stocking on hill-farms . . 383
Pasture plants on hilly ground 383
Heather-burning 383
Sheep-washing—
Objects in washing . . . 384
Opposition to washing . . 384
Methods of washing . . 384
Time of washing . . . 384
Shearing of sheep . . . 384
Time of shearing . . . 384
Force at clipping . . . 385
Wool-shears 385
Methods of clipping . . 385
Shearing lambs . . . 385
Sheep-shearing machines . . 385
Storing wool 385
Weaning lambs 386
Treatment of ewes and lambs . 386
After-treatment of lambs. . 386
Fattening lambs . . . 386
Drafting lambs . . . 386
Marking sheep 386
Registering marks . . . 387
Dipping sheep 387
Former customs . . . 387

Bathing 387
Smearing 387
Dipping 387
Process of dipping . . 387
Construction of dipping-bath . 387
Swimming-bath . . . 387
Process of dipping . . 388
Plans of bath . . . 388
Cost of bath 389
Stone and wood baths . . 389
Tossing sheep into bath . 389
Plunge-bath . . . 389
Dipping mixtures . . . 389
Non-poisonous dips . . 389
Composition of dips . . 389
Time for dipping . . . 389
Weather for dipping . . 390
Dressing for scab . . . 390
Tupping season 390
Flushing ewes 390
Fertility in sheep . . . 390
Management in tupping season 390
Sheep in winter 390
Sheep on turnips in winter . . 391
Preparing turnips for sheep . 391
Enclosing sheep on turnips . 391
Nets for enclosing sheep . . 391
Setting sheep-nets . . 391
Shepherd's knot . . . 392
Wire nets 392
Extent of roots given at a time 392
Carting turnips to lea land in wet weather 392
Turnips risky for ewes . . 393
Draft ewes on turnips . . 393
Young sheep on turnips . . 393
Turnip-tops for sheep . . 393
Dry food with turnips . . . 393
South of Scotland methods . 393
Sheep-fodder racks . . . 394
Substitutes for feeding-racks . 394
Supplying fodder . . 394
Picking out turnip-shells . . 394
Cutting turnips for sheep . 395
The cutter cart . . . 395
Cake-breaker . . . 396
Oats and hay for hoggs . . 396
Salt for sheep . . . 396
Sheep on turnips during snow . 396
Unripe turnips dangerous . 396
Blackface sheep in winter 396
Sheep in a wood in a snow-storm 396
Rape for sheep . . . 396
Shelter for sheep on turnips . 397
Experiments with foods for sheep on roots . . . 397
Cost of turnip-feeding for sheep 398
House-feeding of sheep—
Feeding sheep in sheds . . 398
A Ross-shire example . . 398
Sheep-feeding shed . . . 398
Wintering sheep on pastoral farms . 399
"Home-wintering" or "sending away." 399
Wintering sheep in Romney Marsh 400
Saving hay for hill-farms . . 400
Arable land on sheep-farms . . 400
Irrigation on hill-farms . . 400
Shelter on sheep-farms . . 401
Stells for sheep 401
Outside stell 401
Sheep-cots or sheds . . . 401
Paddocks for sheep . . . 401
Forming plantation stells . 401
Size of stells 402
Concave stells 402
Inside stells 402
Circular stells 403
Giving hay at stells . . . 403
General notes—
Bridging rivulets for sheep . 403
Young sheep best for hill-farms 403
Nomenclature of sheep . . 403

BRITISH WOOL.

Origin, characteristics, and uses . 404
Classification of wools . . . 405
Long wools—
Lincoln wool 406
Leicester wool 406
Cotswold wool 406
Border Leicester wool . . 406
Wensleydale wool . . . 406
Fleece of Devon long-wools . 406
Romney Marsh wool . . 406
Short-wool breeds . . . 406
Shropshire wool 406
Other Down wool . . . 406
Ryeland wool . . . 406
Dorset Horn wool . . 406
Mountain breeds—
Blackface wool . . . 407
Cheviot wool 407
Lonk wool 407
Herdwick wool 407
Dartmoor and Exmoor wools . 407
Welsh wools . . . 407
Irish sheep and wools . 407

MARKETING OF LIVE STOCK AND DEAD MEAT.

Historical 407
Modern fairs 408
The marketing of dairy produce . 409
Marketing of live stock . . . 409
Live- and dead-weight of pigs . 410
Table showing the price per live-weight of cattle . . . 411
Carcase competitions . . . 412
The meat-supply 413
Marketing of meats . . . 414
Farmers as retailers . 416

INSECT ENEMIES OF LIVE STOCK.

Insects 417, 418
The two-winged flies . . . 418
True gad-flies 418
Ox gad-fly 418
The cleg 418
Blinding breeze flies . . 418
Œstridæ or bot-flies . . . 418
Horse bot-flies 419
The ox-warble flies . . . 420
The sheep nostril-fly . . . 421
The tsetse-fly 421
The stable-fly 422
The common house-fly . . 422
The blue-bottles or meat-flies . 423
The green-bottles . . . 423
Sheep maggot-fly 423
The flesh-flies 424
The ked or kade or sheep louse-fly 424
The forest-fly 424
The deer forest-fly . . . 425
Blood-sucking lice or pediculidæ . 425
Biting lice or mallophaga . . 426
Acarina or mites 427
Mange, itch, or scab mites . . 429
Scaly leg of the fowl . . . 431
Feather-eating mites . . . 431
Common sheep scab . . . 432
Lime and sulphur dip . . . 433
Carbolic acid and soft-soap dip . 433
Tobacco and sulphur dip . . 433
Ticks 433

AILMENTS OF FARM LIVE STOCK.

Index of subjects 436
Horses 438
Cattle 466
Sheep 484
Swine 490
Dogs 493
Recipes 493
Administering medicine . . . 496
Fomentation 497
Enemas 497
Back-racking 497
Poultices 497
Castration 497
Spaying 498
Docking 498
Setoning 498
Nursing the sick 499
Table of pulse, respiration, temperature, and gestation of animals 499

General Index to Volumes I., II., and III. 501

LIST OF ILLUSTRATIONS IN VOLUME III.

ANIMAL PORTRAITS.

HORSES.

	No. of Plate.
CLYDESDALE STALLION	9
CLYDESDALE STALLION	10
CLYDESDALE MARE	11
SHIRE STALLION	12
SHIRE MARE	13
SUFFOLK MARE	14
SUFFOLK STALLION	15
THOROUGHBRED STALLION	16
HUNTER GELDING	17
CLEVELAND BAY MARE	18
HACKNEY STALLION	19
HACKNEY PONY STALLION POLO PONY MARE	20
SHETLAND PONY STALLION WELSH PONY STALLION	21
HIGHLAND PONY STALLION	22
CONNEMARA PONY FELL PONY	23
EXMOOR PONY DARTMOOR PONY NEW FOREST PONY	24
GROUP OF PONIES DONKEY STALLION	25

CATTLE.

SHORTHORN BULL	26
SHORTHORN COW	27
LINCOLN RED SHORTHORN COW	28
HEREFORD BULL	29
HEREFORD COW	30
DEVON BULL	31
SOUTH DEVON BULL	32
SUSSEX COW	33
RED POLLED COW	34
LONGHORN BULL	35
ABERDEEN-ANGUS BULL	36
ABERDEEN-ANGUS COW	37
GALLOWAY BULL	38
GALLOWAY COW	39
HIGHLAND BULL	40
HIGHLAND COW	41
AYRSHIRE COW	42
WELSH COW	43
JERSEY COW	44
GUERNSEY COW	45
KERRY COW	46
DEXTER COW	47
GROUP OF DEXTER SHORTHORNS	48
WILD WHITE CATTLE	49

SHEEP.

LEICESTER RAM BORDER LEICESTER RAM	50
LINCOLN RAM COTSWOLD RAM	51
SOUTHDOWN RAM SHROPSHIRE RAM	52
OXFORD DOWN RAM HAMPSHIRE DOWN RAM	53
BLACKFACE RAMS (GROUP)	54
BLACKFACE RAM BLACKFACE EWE	55
CHEVIOT RAM HALF-BRED RAM	56
RYELAND RAM SUFFOLK RAM	57
DEVON LONG-WOOL RAM SOUTH DEVON RAM	58
DORSET DOWN RAM DORSET HORN RAM	59
DARTMOOR RAM EXMOOR RAM	60
LONK RAM WENSLEYDALE RAM	61
HERDWICK RAM KENT OR ROMNEY MARSH RAM	62
WELSH EWES KERRY HILL (WALES) RAM	63
ROSCOMMON RAM DERBYSHIRE GRITSTONE RAM	64

SWINE.

LARGE WHITE SOW LARGE WHITE BOAR	65
MIDDLE WHITE SOW ULSTER LARGE WHITE BOAR	66
LARGE BLACK SOW BERKSHIRE SOW	67
TAMWORTH SOW LINCOLN CURLY-COATED SOW	68

NOTE.—*The portraits in the plates are in all cases reproduced from photographs of the living animals, the great majority of the photographs having been taken by those highly successful and widely known live-stock photographers, Mr C. Reid, Wishaw; Mr G. H. Parsons, Alsager, Cheshire; Mr F. Babbage, London; Messrs Brown & Co., Lanark; and the Sport and General Illustrations Co., London. Excellent photographs for the work were also received from Messrs Lafayette, Dublin; Messrs Chancellor, Dublin; Mr D. M'George, Coupar-Angus; Mr G. Wickens, Bangor; Mr Hayworth, Knighton, Radnorshire; Mr Marshall, Henley-on-Thames; Mr Gay, South Brent, South Devon; Mr Abernethy, Belfast; and others. Messrs Hislop & Day, Edinburgh, gave the utmost care to the preparation of the plates.*

GENERAL ILLUSTRATIONS.

FIG.		PAGE
701.	Donkey mare and foal	60
702.	Pair of mules	61
703.	Shetland cow	137
704.	System of ear-marking sheep	167
705.	Sheep-drawing pen	167
706.	Feeding-box for sheep	169
707.	Trough and pens for foot-rot dressing	170
708.	Shetland sheep	204
709.	Iceland sheep	205
710.	Merino ram	205
711.	Swiss horned goat and kid	209
712.	Sties for brood-sows under one roof	219
713.	Ring pigs' trough, to stand in a court	223
714.	Minorca cock	241
715.	Minorca hen	241
716.	White Leghorn cock	241
717.	White Leghorn hen	241
718.	Coloured Dorking cock and hen	242
719.	Indian Game cock and hen	242
720.	Old English Game cock and hen	242
721.	Black Orpington hen	242
722.	White Orpingtons	242
723.	White Wyandotte cock	243
724.	White Wyandotte hen	243
725.	Plymouth Rock cock	243
726.	Plymouth Rock hen	243
727.	Poultry-house on wheels	244
728, 729.	Movable poultry-houses	244
730.	Coop and run	244
731.	Shelter-coop	244
732.	A colony poultry-farm	244
733.	Incubator	244
734.	Foster-mother for rearing chickens	244
735.	Bearded collie	265
736.	Smooth-coated collie	265
737.	Rough-coated collie	266
738.	Curry-comb, brush, foot-picker, and mane-comb	314
739.	Water-brush	315
740.	Hand whin-bruiser	320
741.	Horse-clippers	324
742.	Bullock-holder	333
743.	Head of timothy with ergots	334
744.	Milking-stool	341
745.	Wallace's milking-machine — teat-cups and milk-pail	343
746.	Steam food-preparing machinery	356
747.	Wool-shears	385
748.	Hand-power sheep-shearer	385
749.	Bath-stool for sheep	387
750.	Dipping-bath	388
751.	English hurdle	391
752.	Shepherd's knot	392
753.	Kirkwood's wire sheep-fodder rack	394
754.	Elder's sheep-fodder rack	394
755.	Trough for turnip sheep-feeding	394
756.	Turnip-picker	395
757.	Gardner's cylindrical turnip-cutter	395
758.	Elder's turnip-cutting cart	395
759.	Oilcake-breaker	396
760.	Sheep-feeding shed — exterior and interior	399
761.	Outside stell sheltered by plantation	401
762.	Outside stell without plantation	402
763.	Inside stell sheltered by plantation	402
764.	Circular stell	403
765.	Live stock weighing-machine	410
766.	Side of beef	414
767.	Cutting up of a carcase of mutton	415
768.	Side of bacon	416
769.	Carcase of pork	417
770.	Gastrophilus equi (yellow-brown fly)	419
771.	The Sheep Nostril-fly	421
772.	Ked or Kade or Sheep Louse-fly	424
773.	Demodex folliculorum (mange mite)	428
774.	The Harvest Bug	428
775.	Sarcoptes scabiei (mange mite)	430
776.	Psoroptes communis (sheep scab) (male)	432
777.	Psoroptes communis (female)	432

THE

BOOK OF THE FARM.

FARM LIVE STOCK.

In the number, variety, and character of its races of farm live stock, the United Kingdom possesses a source of wealth that is practically inexhaustible, and that may for many years go on increasing. Not only are the numbers of animals that are maintained exceptionally large for the extent of territory, but by the skill and enterprise of the owners and occupiers of land in this country the many breeds and varieties of British farm stock have been raised to a general standard of merit that is universally acknowledged to be unique.

It was vastly to the advantage of early improvers of live stock in the British Isles that in the native races they had the very choicest of material to work upon. In each of the different classes of stock there was a variety of type that seemed almost endless, and not only this, but the dominant characteristics throughout all were those represented in symmetrical formation and high value for practical purposes.

It is interesting, indeed, to note that all through the ages of recorded history this country has been strangely free from animals, either tame or wild, with "humps" or with bodies otherwise prominently ill-proportioned. True it certainly is that, long before scientific breeders got their hands upon them, British live stock were distinguished for the symmetry of their formation as well as for the robustness of their constitution. To seek for an explanation of these characteristics would be difficult and of little avail. Not so difficult is it to account for the almost endless variety of type represented in the native races of British live stock. It is by nature's own bountiful design that the *fauna* as well as the *flora* of a country become modified by environment. Great as was the variety in the type of British native live stock, it was no greater than the infinite variation in the climatic conditions, geological formation, and general natural phenomena of the British Isles would lead one to expect.

In itself this wonderful variety of type has been an element of inestimable value in the hands of skilful breeders. In the raising up of races of stock specially adapted for peculiar surroundings and for different purposes, it has enabled them to reach a higher degree of success than could have otherwise been attained. But it is also true that the value of that element of variety has been vastly enhanced by the inherent regularity of structure so characteristic of almost all the numerous native types of stock.

In nearly all civilised countries British live stock are being employed in the improvement of the native races. The results obtained are everywhere striking.

In no respect are they more so than in an unvarying tendency towards a truer harmony in formation. Under the influence of British stock the coarse, ungainly irregularities of native foreign races disappear with unfailing certainty, often with a rapidity that is amazing. To students of heredity this result is not in any sense surprising. Of all the useful characteristics possessed by British breeds of live stock, none are older or more strongly established than their unique symmetry of structure; and so, in obedience to the beneficent laws of nature, this valuable hereditary force exercises a paramount influence wherever it is employed.

Not only have live stock improvers in this country guarded with jealous care the finely proportioned structure and other valuable properties of our native races of animals, but have, as the outcome of long years of skilful breeding and general management, so developed the general utilitarian qualities as to vastly increase their value for the various practical purposes for which farm live stock are bred and reared. And of all this the net result is that the United Kingdom has come to be looked upon as the parental stud-farm for enterprising stock-owners in all advancing countries.

It is not surprising, therefore, that, with the greatly depreciated values of grain in spite of a growing population, live stock interests bulk more largely now than ever before in the fabric of British agriculture. This important development naturally demanded, and has received, due consideration in the preparation of the Fifth Edition of *The Book of the Farm*. It was decided that this, the Third Volume of the work, should be devoted exclusively to the Live Stock branch of agriculture, and in order to ensure, as far as practicable, that the volume shall be worthy of its great purpose—the promotion of British live stock interests—the matter for it has been almost entirely rewritten. In this important work valuable assistance has been willingly afforded not only by many leading writers on live stock matters, but also by a large number of men who have attained distinction as breeders of different classes of farm animals, and to all these the grateful thanks of the Publishers and Editor are heartily accorded.

BREEDS OF HORSES.

There are differences of opinion as to whether the horse had a single or a multiple origin. The former is the prevailing view, but Professor Cossar Ewart and others maintain the latter.[1] Low gives the following as the six species of the "one genus of the tribe—namely, Equus": (1) *Equus asinus*—the ass; (2) *Equus zebra*—the zebra; (3) *Equus quagga*—the quagga; (4) *Equus Burchellii*—the striped quagga or zebra of the plains; (5) *Equus hemionus*—the dziggetai; and (6) *Equus caballus*—the common horse.[2] To this classification Professor Cossar Ewart, in the article just quoted, adds *Equus caballus celticus*—the Celtic pony.

It is, of course, with the common horse that we are mainly concerned. Low thinks it natural to refer the origin of the horse to the countries of Western Asia to the southward of the Euxine and Caspian Seas, but he acknowledges the probability that the species may also have been diffused from Africa and Eastern Asia.

When the horse was introduced into Great Britain is not known. Julius Cæsar found it here in large numbers when he invaded the country fifty-four years before the Christian era. Whether these early British horses were brought from the East in a state of domestication or reclaimed from the wild horses roaming in the wastes of Europe is uncertain. Little is known of the character of the horses in Great Britain at the time of the Roman invasion, but it is believed that they were of a somewhat coarse, draught-horse type, strongly built, but lacking in quality and action. It is further believed that for several centuries little change was effected upon British horses, beyond such variation as would be induced by the differences in their environment throughout the country. It was apparently not till some time after the Norman Conquest that the systematic improvement of British horses had made

[1] "The Multiple Origin of Horses and Ponies." *Trans. High. and Agric. Soc. of Scotland*, 1904.

[2] Low's *Domesticated Animals of the British Islands*, 1842.

substantial progress. Superior breeds of horses were introduced by the Normans from the continent of Europe, including the great black horse of Flanders and Germany; and gradually better classes of horses were bred in this country.

More marked still were the changes for the better which were brought about in British horses by the establishing of the race of English Thoroughbreds in the time of James I. In the building up of that noble breed the choicest of material was drawn from the countries of the Mediterranean, and still more effectually from the distant deserts of Syria and Arabia. Of the influence exerted upon British horses by the Thoroughbred, Low writes: "The effect has been that a breed of horses has been formed of peculiar lineage and characters, and been mingled in blood with the native varieties in every degree. In this manner the property of blood, as it is technically termed, has been communicated to the inferior races, and varieties have been multiplied without limits. Not only does there exist the diversity of what may be termed natural breeds, but those further differences by the greater or less degree of breeding communicated to individuals. Many remain with little or no admixture of the blood of the race-horse, and so may be regarded as native breeds or families; but others are so mixed with the superior horses, or with one another, that they cannot be treated as breeds, but must be regarded as classes suited to particular uses."[1]

It is of the varied material thus described that the present-day breeds of British horses and ponies have been built up. Some of the mixed "classes" referred to by Low have disappeared, but others have been cultivated with such skill and enterprise that they have developed into well-established breeds of great value.

It is known that the ass existed in this country in the time of the Anglo-Saxon kings, but it did not become numerous for several centuries afterwards. As the poor man's horse the ass has long had an established position in the British Isles, and especially in Ireland it is now kept in large numbers.

The faithful and patient mule is a follower of the ass, and so useful and thrifty is it that one wonders it is not reared to a much larger extent than is the case in this country.

The Thoroughbred, with as free will as ever, still stands at the head of British horses. It is followed by a large number of races of riding and driving horses and ponies, including the Hunter, Cleveland Bay, Yorkshire Coach-horse, Hackney, Hackney Pony, Polo Pony, Welsh Ponies, Fell Ponies, the Connemara Pony, Exmoor and Dartmoor Ponies, New Forest Ponies, Highland Ponies, and Shetland Ponies. Several of these varieties, notably the Cleveland Bay, Yorkshire Coach-horse, and the heavier of the Connemara, Fell, and Highland Ponies, are used largely for draught purposes, as well as for riding and driving.

Of draught-horses in the stricter sense there are now only three recognised breeds in the British Isles. These are the Shire, the Clydesdale, and the Suffolk breeds. Outside the limits of these distinct breeds there are numerous varieties of draught-horses of a generally useful character. They are of mixed breeding, differing greatly in type and weight, but, on the whole, well fitted for their respective spheres of usefulness.

BREEDS OF CATTLE.

All varieties of cattle, whether wild or domesticated, belong to the Taurine group of the Bovine race, the other groups being the Bisontine—the bison tribe, and the Bubaline — the buffalo tribe. As to the early history of the British varieties of cattle there has from time to time been much discussion. Even yet their true origin is to some extent shrouded in mystery, and it is unlikely that all uncertainties will ever be fully cleared up.

Amongst leading authorities the prevailing view is that the breeds of cattle to be found in the United Kingdom at the present day all trace their descent from those two types of the sub-genus *Bos taurus*, — the *Bos urus* and *Bos longifrons*.

[1] Low's *Domesticated Animals of the British Islands*, 1842.

The *Bos urus*, known also as *Bos primigenius*, was a type that attained to gigantic dimensions, far in excess of any living variety of cattle. It is recorded that in specimens of the type the length of the body, including the head, was about 11 feet, the height at the mane 6 feet 6 inches, the span of the horns 2 feet 2 inches, and the girth of the horns at the base 14 inches. The *Bos longifrons* type was much smaller—often smaller, it seems, than some of the existing varieties of cattle.

Except in the matter of size, there was little if any difference between the two types, and thus there are those who regard the *Bos urus* and the *Bos longifrons* as belonging to the same species. Low says: "We can, by all the evidence which the question admits of, trace existing races to the ancient uri which, long posterior to the historical era, inhabited the forests of Germany, Gaul, Britain, and other countries. It is a question involving an entirely different series of considerations whether these uri were themselves descended from an anterior race, surpassing them in magnitude, and inhabiting the globe at the same time with other extinct species. While there is nothing that can directly support this hypothesis, there is nothing certainly founded on analogy that can enable us to invalidate it. There is nothing more incredible in the supposition that animals should diminish in size, with changes in the condition of the earth, than that they should be extinguished altogether and supplanted by new species. The fossil urus inhabited Europe when a very different condition existed with regard to temperature, the supplies of vegetable food, and the consequent development of animal forms. Why should not the urus, under these conditions, have been a far larger animal than he subsequently became? We know by experience the effects of food in increasing or diminishing the size of this very race of animals. The great ox of the Lincolnshire fens exceeds in size the little ox of Barbary or the Highland hills, as much as the fossil urus exceeded the larger oxen of Germany and England; and we cannot consider it as incredible, that animals which inhabited Europe when elephants found food and a climate suited to their natures, should have greatly surpassed in magnitude the same species under the present conditions of the same countries."[1]

It is believed that the *Bos longifrons* was the only type of domesticated cattle in Britain at the time of the Roman invasion. Many of them, it is said, were driven with their owners into the remote regions of the country, where they remained in purity for ages. It has been suggested by high authorities that the purest descendants of these cattle are to be found in the horned breeds of the Highlands of Scotland, of Wales, and of Ireland. It is further recorded that by the Romans, the Danes, and others, improved varieties of large cattle were imported into Britain and crossed with the cattle of the *longifrons* type, but little is known as to the particular varieties thus introduced. It has been held by some ancient writers that the *Bos urus* never was domesticated in the British Isles, or, at any rate, only to a limited extent. That it was tamed on the European continent is well established, and it is supposed that, amongst other sorts, the Romans had taken animals of the *urus* type with them to Britain. Thus, while there is much that is obscure in the ancient history of British cattle, it may safely be assumed that the breeds of cattle which now exist in this country can claim descent from different branches of the Taurine group.

WILD WHITE CATTLE.

There still exist in this country some singularly interesting remnants of the wild cattle which at one time roamed in freedom through British forests. The most notable herds of these old-world cattle are the Duke of Hamilton's herd in Cadzow Park, in the county of Lanark, and the Earl of Tankerville's herd in Chillingham Park, Belford, Northumberland.

Cadzow Park Wild White Cattle.

Cadzow Park formed part of the great Caledonian Forest, and it is believed that the herd of semi-wild cattle now enclosed

[1] Low's *Domesticated Animals of the British Islands*, 1842.

there are direct descendants of the wild cattle which, as late as the sixteenth century, roamed through that vast preserve of wood and moor. Low states that all the characters of the Cadzow Park cattle show them "indubitably to be the descendants of the ancient race." He adds: "They are of the size of the cattle of the West Highlands; they are of a dun-white colour; the muzzle, the inside of the ears, the tongue, and the hoofs are black. They are very wild, and cautious of being approached; when suddenly come upon they scamper off, turn round, as if to smell and examine the intruder, and generally gallop in circles, as if meditating an attack. They are not, however, vicious, though some of the bulls have manifested the savage and dogged temper of their race. Some persons have been pursued to trees. . . . The females conceal their calves amongst thickets or long grass, returning to them cautiously twice or thrice a-day to suckle them. The little creatures exhibit the instincts of their race: when suddenly approached they manifest extreme trepidation, throwing their ears close back upon their necks and squatting upon the ground. The only method of killing the older animals is by shooting them."[1]

In the main, the Cadzow Park cattle have been bred within themselves, but the influence of excessive in-breeding has gradually impaired their constitutional strength. In the hope of correcting this tendency, a bull from the Chillingham Park Wild White herd was introduced in 1886 and mated with a number of selected cows. Most of the earlier crosses were unsatisfactory in their colours and were not used for breeding, but in 1888 two bull calves, true in colour to the Cadzow type, were obtained, and through the use of these and their progeny a marked improvement was effected in the stock.

Again, in 1896, a bull was introduced from the Wild White herd at Vaynol Park in Wales, and as the result of these two infusions of kindred yet fresh blood the Cadzow Wild herd has obtained a new lease of life.

The Cadzow Park cattle have maintained in a wonderful manner the old-time features of their race. They are less timid, but in colour and form there is little change.

In Plate 49 there are reproduced photographs of Cadzow Park Wild White cattle, and of the Chillingham Park Wild White bull introduced in 1886.

Chillingham Park Wild White Cattle.

The Wild White cattle at Chillingham Park, Northumberland, have been declared by various high authorities to be the purest and most characteristic representatives extant of the aboriginal wild cattle of this country. They are more timid than the Cadzow Park cattle, and they are wonderfully robust in constitution considering the closeness with which they have been bred for hundreds of years. There are good grounds for believing that towards the close of the eighteenth century a portion at least of a herd of Wild White cattle, long kept at Drumlanrig in Dumfriesshire, found its way to Chillingham Park, and it may be assumed that the Chillingham Park herd had gained in constitutional strength by that infusion.

The Chillingham Park cattle are wonderfully uniform in their main features. At birth the colour is almost pure white, but gradually it changes into a creamy white. The upper surface of the tongue is slate-coloured, and the under side reddish brown; the horns white, with black tips; the ears red inside and partly red outside; the eyes fringed with long eyelashes; the hoofs and noses black. Their general formation is well proportioned, and it has been said of them that they have such finely set shoulders that they can trot briskly and with the gaiety of race-horses.

As ruling monarch of the herd there is always a "King Bull," the same animal holding this high office usually for two or three years, when, after a fierce fight, he is deposed by a younger and stronger sire. Here, as in Cadzow Park, the calves are secreted by the mothers when born. When killed, the bulls weigh from about 500 to close on 600 lb.; the cows about 50 or 60 lb. less, and the steers 10 to 20 lb. more, than the bulls.

In 1875 Lord Tankerville began experiments in the crossing of the Wild

[1] Low's *Domesticated Animals of the British Islands*, 1842.

cattle with pure-bred Shorthorns. The trials of a Wild bull with Shorthorn females did not succeed on account of the resulting female crosses failing to breed. The mating of a Shorthorn bull with Wild females was quite successful, and a useful variety of cattle has thus been established. Steers bred in this way have won third prizes in the Smithfield Fat Stock Show. One, three years and eight months old, reached 18½ cwt. live-weight, and yielded a carcase of 96 stones. The outward features as well as the fattening properties have been improved by the Shorthorn influence: there has been no loss in hardiness, little change in colour, except that the dark colouring of the nose has nearly disappeared. Shorthorn bulls continue to be used as the sires.

As already mentioned, the Chillingham Park Wild bull taken to Cadzow Park for crossing with that herd is represented in Plate 49.

Other Wild White Herds.

Another interesting herd of Wild White cattle similar to the two already mentioned was long maintained with success in Chartley Park, near Uttoxeter, in the county of Stafford. The Chartley Park herd, which traced back to early in the thirteenth century, ultimately became seriously affected with tuberculosis and other ailments, which, on account of their long-continued in-and-in-breeding, the cattle were not well able to withstand. Partly through deaths, and partly by the sale of a number of animals to the Duke of Bedford in 1905, the herd became reduced to very small numbers. The Chartley Park cattle were similar to those at Cadzow and Chillingham, but black calves occasionally appeared amongst them.

At Vaynol Park, near Bangor, a herd of Wild White cattle has been maintained since 1872. In that year the herd was founded by Mr G. W. Duff Assheton-Smith by the purchase of twenty-two cattle from Sir John Orde of Kilmory, Argyllshire, the remainder of the Kilmory herd being taken to Vaynol Park fourteen years later. The Kilmory herd was founded by stock tracing from a Wild White herd which was kept for a time by the Duke of Atholl, at Blair-Atholl in Perthshire, and which in 1834 was purchased partly by the Duke of Buccleuch, Dalkeith Park, Edinburgh, and partly by the Marquis of Breadalbane, Taymouth Castle, Perthshire. Crosses of white West Highland cattle were introduced at Kilmory, and the beneficial influence of the West Highland blood can easily be traced in the thick, well-fleshed, handsome cows of the Vaynol Park herd shown in Plate 49.

It was from the Vaynol Park herd that, in 1890, a Wild White heifer was sent to the Zoological Gardens, London, where she bred successfully to a Wild White bull introduced from the herd at Chartley Park.

MODERN BRITISH CATTLE.

Not for a long period of time has foreign blood been infused into British breeds of cattle to any considerable extent. Such changes and improvements as recent generations of breeders have effected—and they have assuredly been remarkable alike in character and value—have been brought about by skilful handling of native material. It is doubtful if in the annals of Agriculture there is to be found a more striking feature than the very marked improvements effected upon British breeds of cattle since the middle of the nineteenth century. The nature and extent of these improvements will be indicated more fully in the appended descriptions of the different breeds. It suffices here to observe that, with the wealth and variety of material which has long existed in the British races of cattle, the skilful breeder has no need to resort to infusions of foreign blood.

Breeds of cattle are commonly divided into horned and hornless varieties. Of the hornless cattle there are now only three recognised breeds in the British Isles—the Aberdeen-Angus, the Galloway, and the Red Polled breed of Norfolk. Of the horned cattle there are many breeds and varieties, the more important being the Shorthorn, Red Lincoln Shorthorn, Hereford, Devon, South Devon, Sussex, Long-horn, Ayrshire, Highland, Welsh, Kerry, Dexter, Jersey, Guernsey, and Dexter-Shorthorn.

In addition to these established breeds

of cattle there are numerous sub-varieties and types of crosses which are bred extensively in different parts of the country. Some of these might well be developed into distinctive breeds, but it happens that the tendency is rather in the other direction, to allow these mixed types to lose such individuality as they possess. In this way several types of cattle that at one time or other commanded attention in various parts of the country have disappeared either wholly or partially. Amongst these may be mentioned the black horned cattle of the North-east of Scotland, the black horned breed of the county of Fife, the Glamorgan and White Pembroke cattle of Wales, and varieties long associated with the county of Gloucester.

BREEDS OF SHEEP.

It is generally agreed amongst naturalists that the domesticated races of sheep trace descent from certain wild species of the genus Ovis. The numerous varieties now existing throughout Europe are believed to be descended from the Argali or Wild sheep of Asia and the Wild musmon of Southern Europe, the latter being a species almost identical with the Rocky Mountain sheep of America. Similarly the domestic sheep of Africa seem to have been raised from wild species native to that great continent.

In ancient history, both sacred and profane, there is ample evidence of the useful part played by the sheep in the life and affairs of the human race even in its earliest days. Man has always been keen to appreciate the benefits derivable from the cultivation of the Ovine tribes, and it is safe to say that at the opening of the twentieth century varied flocks of domesticated sheep made up a larger proportion of the great fabric of agriculture than was the case at any previous time in the history of the world.

The varieties of sheep established in Europe at one time or other have been very numerous. They have also shown much diversity in form and character. Broadly speaking, all varieties were divided into two classes — long-tailed sheep and short-tailed sheep. The former were by much the more numerous, the greater proportion of the flocks in the West of Europe being of the long-tailed sorts. In most cases there was a strange development of fat on the tail, but, except in a few varieties, this peculiarity has to a large extent disappeared. Short-tailed sheep, which were favoured by Slavonic nations, made their way to northern parts of the British Isles through the agency of Scandinavian invaders, but they were not of sufficient utility to secure for them an enduring position amongst the more profitable races of long-tailed sheep which hold sway throughout this country.

In the British Islands at the present day there are to be found a greater number of races of high-class rent-paying sheep than are known to exist in any other country. Alike in size, form, and outstanding features generally, they present variation that is quite remarkable. To some extent this diversity may be due to a difference of descent. In large measure it has arisen from the long-sustained influence of environment—the influence of soil, climate, and food. To a still greater extent the diversity, as well as the general high standard of merit displayed by the numerous types, has been brought about by the skill and the enterprise of British flock-owners in pursuing the science and the art of stock breeding.

It is a common practice to classify sheep according to whether the staple of their wool is long or short. In the case of some races there are differences of opinion as to the class in which they should be placed. It may be as well, therefore, to arrange the different breeds and types into three groups—(1) Long-wools, (2) Short-wools and Downs, and (3) Mountain and Moorland sheep.

Of long-wooled sheep the recognised existing varieties are—Leicester, Border Leicester, Lincoln, Cotswold, Devon Long-wools, South Devon, Wensleydale, Kent and Romney Marsh, Roscommon, and Half-bred.

The short-wooled and Down races are —Southdown, Shropshire, Hampshire, Oxford Down, Suffolk, Ryeland, Dorset Down, Dorset and Somerset Horn, Radnor and Norfolk.

The Mountain and Moorland sheep comprise the Blackface, Cheviot, Exmoor, Dartmoor, Lonk, Herdwick, Welsh, Kerry Hill (Wales), Derbyshire Gritstone, Shetland, &c.

A number of other varieties are kept to some extent in certain districts, but the more important breeds and types are enumerated above.

GOATS.

The goat is so closely allied to the sheep that naturalists have not been in complete agreement in distinguishing between the two. The domesticated goat is generally regarded as being descended from one or more of the caprine group—most largely, it is believed, from *Capra ægagrus*, but partly also from *Capra ibex*, the Alpine ibex, and probably some of the other varieties of the tribe.

The goat would seem to have made its way to the British Isles from the continent of Europe. The best variety of goats in this country resemble pretty closely the more highly-prized goats in the countries of the Mediterranean. Less attention is now given to the rearing of goats in the British Isles than prior to about 1830; but in Ireland and in some other parts they are still cultivated,—this, too, with much advantage to their owners.

BREEDS OF SWINE.

The Wild Hog, *Sus aper*, is universally regarded as the progenitor of the many existing domesticated races of swine. That species was widely distributed throughout the old continent in early times, and still roams in a wild state through woods and wastes in the European continent and in countries farther east. Wild swine existed in this country prior to the Norman Conquest, but that their numbers were gradually declining is indicated by the fact that William the First passed a law providing that any one found guilty of killing a Wild Boar should have his eyes put out. Various writers refer to wild swine as existing in the English and Caledonian forests in the twelfth century, but in course of time, at a date not definitely known, the species ceased to exist in this country.

Not only were the native domesticated swine of this country derived from the Wild Hog, *Sus aper*, but at various times fresh draughts of the pure wild blood were infused into the tame varieties, which were thereby reinvigorated to a marked extent.

British races of swine for long consisted mainly of two varieties. The one was of large size, somewhat ungainly in form, with long drooping ears, and slow in fattening. The other variety was smaller, with short erect ears, more easily fattened than the larger sort, but rather coarse and fibrous in flesh. While these were the only races that were distinctive enough to be regarded as breeds, many other varieties of greatly diversified characters existed throughout the country.

Happily the British Islands are now in possession of numerous excellent well-established breeds and types of swine. Broadly speaking, almost all these varieties have been built up from the native breeds by the admixture of strains introduced from the East—chiefly from China and the Mediterranean countries. For the production of high-class ham and bacon at an early age the British swine have been vastly improved by the influence of these imported races, and from this excellent material modern breeders and feeders have attained great success in the swine-rearing industry.

The leading varieties of swine now kept in the British Islands are the Large White, Middle White, Berkshire, Large Black, Lincoln Curly, Tamworth, and the Ulster Large White. Several other sorts are still kept to a certain extent, the most important of these being the Small Blacks, Small Whites, and local varieties reared in Gloucester, Dorset, Hampshire, and Sussex.

THE SHIRE HORSE.

For a long period of time the Shire has been the leading variety of draught-horses in England. The breed is widely distributed over the country, and is a valuable source of wealth and power.

Origin.—The Shire horse of to-day is the lineal descendant of the Old English War-horse, which, alike for its strength and courage, excited the surprise and admiration of the Romans when they first invaded England. It may not be the only surviving descendant of that noble race of horses, but it is now generally regarded as the purest living representative of that earlier type.

In an interesting brochure entitled *A Short History, tracing the Shire Horse to the Old English Great Horse*, Sir Walter Gilbey states that investigations appear to establish that the Shire horse is the closest representative of—the purest in descent from—the oldest form of horse in the island. "A thousand years ago," says this authority, "this form was written of as 'The Great Horse'; and nearly a thousand years before that we have evidence which goes to prove that the same stamp of horse then existed in Britain, and that it was admitted by those who saw it here to be something different from—and something better of its kind than—what any of the witnesses (of that day) had seen before: and they had seen most of the horses of those times."

Name of the Breed.—For a long time prior to the advent of the nineteenth century, and for many years thereafter, the breed was widely known as the Large Black Old English Horse. It is now universally recognised by the title of "Shire," derived from "the Shire counties in the heart of England," in which, according to Arthur Young, who wrote near the end of the eighteenth century, the Old English Horse was principally produced.

Shire Horse Society.—The desirability of taking steps to encourage the improvement of the old English breed of cart-horses was brought into public notice by a paper read by Mr Frederick Street at the Farmers' Club, London, in 1878. The result was the establishment of the Shire Horse Society, under whose fostering care the breed has been vastly improved,—made more uniform in type and character, and much sounder in wind and limb. The Shire Horse Society issue a volume of the *Shire Stud-Book* every year. The first volume, published in 1880, contains the pedigrees of 2380 stallions, many of which were foaled in the eighteenth century. The Society likewise holds a great Shire Horse Show in London every spring, and this show has done much to further the interests of the breed. The first show was held in 1880, and as many as 862 entries have been recorded, and as much as £2220 in prizes offered at a single show.

The Society's schemes for the improvement of the breed include distribution of medals, of which the winners may obtain their equivalent in money if preferred.

Veterinary Inspection.—The Shire Horse Society adopted veterinary inspection at its shows, and only awards prizes and medals to animals passed as sound by recognised veterinary inspectors. As indicative of the condition to which the breed has been brought by attention to this matter, it may be stated that in 1908, of 248 horses examined 237 were passed sound. The 11 which were rejected were cast as follows: 2 roarers, 1 whistler, 1 wind, 2 shiverers, 1 side-bone, 2 ringbone, 1 cataract, and 1 lame. This is a small percentage, and clearly proves the wisdom of making it a condition of showing that hereditary unsoundness is a disqualification.

Distribution.—The Shire horse is found in every part of England and Wales, from Northumberland in the north to Cornwall in the south, and from Lincolnshire in the east to Carmarthen in the west. It is to be seen at its best in Lincolnshire and the fen country generally, in the midlands, in Derbyshire and Lancashire.

Land and Water for Breeding.—The heaviest lands are the best for breeding heavy horses. Limestone land, such as exists in Derbyshire, is also greatly

favoured. The two most famous and historic parts of England in the breeding of draught-horses are the fens of Lincolnshire and the valleys and flats of Derbyshire. Shire horses are bred on comparatively light soils in the south of England, but difficulty is experienced in growing them big enough without forcing feeding. In summer, when the land bakes and cracks, it is almost impossible to keep young foals on their joints. Consequently many stud owners have established the practice of hiring grazing in a more suitable neighbourhood for the summer season.

Breeders are not agreed as to what constitutes growing qualities in the land. Many appear to think that the water-supply has much to do with it. The writer has had confirmation of this theory from many sources. Fields on a particular farm were known to grow stock much better than others, and the water for these issued from a different source. The contention has been put forth that soft water is an important element in producing big draught-horses.

Horse-breeding Societies.—Horse-breeding societies have rapidly increased in number, and the hiring of stud-horses of good breeding and free from disease has done much to drive off the road the "guinea" horse of doubtful parentage and poor character, and afflicted with many of the ailments which horse-flesh is heir to. There are, however, so many studs scattered over England where the use of horses can be conveniently obtained at reduced fees to tenant-farmers (frequently involving an option on the foal), that the establishment of horse-breeding societies is less necessary than would otherwise be the case. In the south and in Wales, however, the movement has made admirable progress.

Fees and "Retainers."—Good horses can be used at prices varying from 3 guineas to 15 guineas. For tenant-farmers the abatement of a 10 guinea fee to 7 guineas is freely made, so that the smaller owner of pedigree mares has every encouragement. The "retainers" offered by societies vary according to the class of mares in the neighbourhood, the wealth of the society, and the enterprise of the farmer. The Welshpool Society has frequently hired at 1000 guineas. Others, again, give a small "retainer," usually about £50 with a guarantee of so many mares, say about 80, at a fixed fee, generally about 3 guineas.

Value of Pedigree Mares.—It is probably a correct estimate to assume that about 85 per cent of the mares served by pedigree stallions are without pedigrees. Farmers are realising, however, that the pedigree mare is a valuable asset. Thus, assuming that two foals are dropped to the same horse—one from a pedigreed mare, and the other from an unpedigreed mare—the one may be worth 100 guineas, and the other from 20 guineas to 30 guineas, while the fee for the service is the same in both cases. In this way a saying has come about that the small farmers of Derbyshire are accustomed to sell a foal to pay the rent.

Public and Private Prices.—Many high prices have been given for Shire horses in the public sale-ring. Those reported to have been offered privately and accepted are: 2000 guineas for the London champion two-year-old, "Bearwardcote Blaze"; 2500 guineas for "Bury Victor Chief," another London champion. In the public sale-ring the highest price has been 1550 guineas for the stallion "Hendre Champion," bought by Mr Leopold Salomons at the late Mr Fred. Crisp's sale. The Premier horse "Chancellor" was sold at a Calwich sale for 1100 guineas. The highest priced mare was his Majesty's three-year-old "Seabreeze," which made 1150 guineas at a Sandringham sale, the late Sir J. Blundell Maple being the buyer. The well-known mare "Hendre Crown Princess" drew 1100 guineas at one of the late Lord Wantage's sales, Mr Smith Carrington being the purchaser.

Amongst averages obtained at public sales the highest was Lord Rothschild's, £266, 14s. for 35 head in 1908. More remarkable still is this figure when it is remembered that all the stock offered were home-bred. The top price was 900 guineas—the highest figure ever given in public for a yearling colt. Lord Llangattock's fine average of £226 for 44 head, and his Majesty's (then Prince of Wales) of £224, 7s. 9d. for 54 head, are likewise landmarks in the history of the breed. Lord Llangattock's sale was held in 1900, while the Sandringham

fixture took place in 1898. In 1899 Mr (now Sir) Alexander Henderson sold 39 head at an average of £209, 3s. 10d.

Mating.—In the mating of mares the skill of the horse-breeder is tested. To some extent it is a matter of luck rather than skill—the use of the nearest horse mayhap. Otherwise how can the fact be accounted for that the smallest breeders, with least pretensions to an extensive and accurate knowledge of breeding, occasionally breed a champion? The using of a heavy stallion to a mare of quality is a safe rule. With a big mare almost any type of horse may be used. The short-legged, lengthy mare is usually associated with the "brood" mare type —*i.e.*, she is that class of mare which in the majority of cases throws a first-class foal. When pedigree is a consideration, back breeding requires to be studied. It is also invaluable to have a knowledge of the leading strains of blood.

Peculiarities of Stallions.—Eminent stud-horses have been known to show marked peculiarities. Thus "Premier" was known chiefly for the high character of mares he left; so was "Royal Albert." "Lincolnshire Lad II." produced stallions which exercised an overmastering influence on the breed: "Harold" was one of them. His mares had a name for lasting well, and his stallions were London champions. "Hitchin Conqueror," again, stamped his produce with wonderful quality and joints, and imparted activity to his stock.

Stallions may be foal-getters—*i.e.*, the young animals are at their best as foals. Others may produce foals that do not do well till they attain maturity. Yet, again, one meets with that class of horse which brings coarse stock; others breed them too fine. And so the catalogue might be continued, but enough has been said to emphasise the importance of a knowledge of the sire and his breeding.

Shire breeders are accustomed to study very closely not only the pedigree but the appearance of an animal. Nowadays the fact that the dam of a good young colt or filly is a good sound mare is sufficient to increase the value of the progeny materially. It is the custom with careful breeders to acquaint themselves with the character of the dam before buying a stud horse.

Foaling.—Foals are sometimes dropped in January, but they are too troublesome to favour the general adoption of a February service. It is found, if they are good enough for the autumn foal shows, that they are seldom so big as those dropped in March and April, which can go on to grass immediately and suffer no check in growth. Late spring and early summer foaling is the rule on most farms, and it is the most convenient.

Forcing Young Stock.—The system of forcing young stock for shows obtains generally among breeders of pedigree Shire horses. It is one of those practices almost unanimously condemned in theory but encouraged in practice. It is impossible to win prizes unless a young animal is very big and weighty. It undoubtedly shortens the period of an animal's usefulness, and may perhaps in some remote degree affect its soundness. The cynic has declared the dominating principle of Shire horse showing has been "soon ripe, soon rotten." While far from approving the contention, the forceful feeding of young stock must be condemned as laying the foundation of future trouble.

In few breeds can two-year-olds be put to service. As a rule, it stunts the growth, but through the method of forcing young stock to great height and weight, it is frequently practised by breeders without ulterior effect upon the subsequent stature of the mare.

Characteristics.

Colour.—As would be inferred from the use of the title the Old English Black Horse, black was no doubt at one time the prevailing colour of the breed. A large number are still black, but bay and brown of varying shades predominate. Many are grey, roan, or chestnut, but light colours are not, as a rule, in favour in the market.

Size.—It is undisputed that the Shire horse is the largest of all the varieties of draught-horses which exist in this country, or indeed in any other country. About 17 hands is a common height amongst the stallions of the breed, although many attain to 17.1 hands and 17.2 hands.

Dimensions and Weight.—The dimensions of the Shire horse form an inter-

esting study. The American system of weighing heavy horses has not yet been adopted in this country, but in the course of time that may come about. Horses over a ton weight are far from being uncommon. The well-known horse "Tatton Friar," owned by the Earl of Egerton, scaled 25 cwt.

Mr Walter Crosland, agent to Sir Alexander Henderson at Buscot Park, Farringdon, has supplied the following measurements of two Shire horses, "Markeaton Royal Harold" and "Buscot Harold." They are both champion winners at London, and "Buscot Harold" was sired by the former out of the London champion mare "Aurea," so that he has a double dose of champion blood. Particulars of these measurements are as follows, those of "Markeaton Royal Harold" being made when he was five years old, and of "Buscot Harold" when three years of age, immediately after each had won his championship at the London Shire Horse Show:—

	Markeaton Royal Harold.	Buscot Harold.
Height	17 hands ½ in.	17 hands.
Girth	8 ft. 1 in.	7 ft. 11 in.
Knee	1 ft. 8 in.	1 ft. 6½ in.
Below knee	1 ft. 1¼ in.	1 ft. ½ in.
Round coronet	1 ft. 8¾ in.	1 ft. 8¾ in.
Hock	1 ft. 11 in.	1 ft. 10 in.
Below hock	1 ft. 2 in.	1 ft. 1¾ in.
Across foot (fore)	7½ in.	7¾ in.
Length of head	2 ft. 6 in.	2 ft. 9 in.
Middle of knee to ground	1 ft. 9 in.	1 ft. 8¾ in.

Doubtless when he reached maturity "Buscot Harold" had considerably improved upon these figures.

"Birdsall Menestrel," Lord Rothschild's champion stallion at the Shire Horse Show (represented in Plate 12), has been measured, and Mr Richardson Carr, in response to our inquiry, supplies the following dimensions:—

BIRDSALL MENESTREL.

Height	17 hands.
Width across sole of fore foot (without shoe)	8 in.
Round fore coronet	21½ in.
Below knee	13 in.
Round knee	19½ in.
Round fore arm	28 in.
Round hock	23 in.
Below hock	15 in.
Girth	8 ft.
Weight at end of 1907	19½ cwt.

The following are the measurements at ten years' old of the 1550 guinea horse "Hendre Champion," owned by Mr Leopold Salomons of Norbury Park, Dorking:—

HENDRE CHAMPION.

Height	17 hands 1 in.
Width of foot	8 in.
Round coronet	20½ in.
Bone below knee	14 in.
Round knee	18½ in.
Round arm	23 in.
Bone below hock-joint	16 in.
Round hock	23¼ in.
Girth	8 ft. 6 in.
Weight	21 cwt.

Form.—When the Shire Horse Society began its good work, the rank and file of the breed presented defects which materially impaired the value of the horses for hard work. Chief of these were short upright pasterns, wide hock action, unsoundness, and sluggish movement. In all these points a marked improvement has been effected. To one who, like the writer, has been regularly attending the London Shire Horse Shows, the contrast between the general characteristics of the animals exhibited at the earlier and later shows is most striking. Nowadays symmetry is as essential in a draught-horse as it is in a Smithfield champion. It is of little use showing the fine muscular development of loin, depth of rib, and beautiful fore end of a draught-horse if he has not thighs to fill the breeching. Symmetry is a great thing, but it does not constitute the alpha and omega of a Shire horse breeder's catechism. The old type of Shire was heavy and cumbersome, set on short legs, but disproportionate in his weight of top. To-day he is a beautifully balanced animal, with better feet and action than he had in bygone times.

Type.—Type may be regarded as the governing force in horse-breeding. A good gelding might be a very poor type of Shire. As a rule, type is shown as much in the character of the head as in the formation of limbs and body. The gaunt, leggy type of horse is of little use to any one who wants equine power concentrated. There are, roughly speaking, two types—the quality and the rougher kind of Shire. In-breeding and the use of pedigree make for qual-

ity: without it stock-breeding could not prosper. Through its aid the type of Shire produced in modern times is more lasting, and will keep on its joints longer with fewer limb ailments than at one time were common.

Quality is found most fully shown in the mares. England is to-day full of breeding stock of high quality. Occasionally there is a tendency to fine down the stallions too much. They lack masculine appearance, and begin to lose that cresty sex-like boldness so characteristic of the older type. The rougher sort of horse has his uses. We do not refer to the round-boned horse whose spongy legs are the happy hunting-ground of grease and divers ailments. But the stallions whose hair has a tendency to curl, and whose bone is not of superfine quality,—in fact, whose appearance is impressive but will not bear close inspection, — that type of horse has his uses, to correct the effeminacy which comes from concentrating attention too much on quality.

Legs and Pasterns.—It is now universally acknowledged that a short upright pastern is an objectionable feature in a horse, whether for draught or other purposes. With such a pastern the shock to the system, in walking, trotting, or galloping under a burden, must obviously be much greater than with the "springy" action of a moderately long sloping pastern. This point is more keenly appreciated in England now than in former times. A long pastern may be a source of weakness, and the Shire breeder aims at a happy medium.

Similar remarks would apply to the general conformation of the legs. The angle of the hind leg has been very carefully studied, more so since horses like "Royal Albert" set the fashion. A common fault is "back at the knee." It indicates muscular weakness of the fore limb. The most common of all faults, however, is lightness of bone below the knee.

Action.—The unduly wide hind action, so prevalent at one time in English draught-horses, is happily becoming much rarer. A bent hind leg, set outside the body, so to speak, is undoubtedly a source of weakness in a draught-horse. An animal with limbs of this sort can have little endurance under hard work. Wide hind action was one of the most notable defects in the earlier London shows of Shire horses. It is rapidly becoming the exception to find wide movers. Of course it must be remembered that the Shire horse is much wider in frame than most other breeds, consequently the closeness of the Clydesdale's action need not be expected, otherwise we should have a race of "cow-hocked" animals.

The demand nowadays runs on very active geldings, and the tendency of the times is altogether favourable to the further development of speedy movement in the draught-horse.

Feet.—The foot of the horse is a point of the utmost importance. It is there very often that, under hard labour, the animal first gives way. Flat soft hoofs cannot be durable, and with the persistent striving for large sound feet with deep strong walls, which has been fostered by the show system, the feet of the rank and file of Shire horses have greatly improved. The breeder looks for a wide and deep heel, and is averse to a too wide coronet, but more so to a narrow one. The most wearing type of hoof is blue, but the advantage of white limbs for show purposes is too apparent to enable the breeder long to resist the incursion of the white and more brittle hoof.

A Typical Shire.—What is a typical Shire? The description given by Mr Frederick Street, in a paper read before the London Farmers' Club in 1878, holds true to-day as it did then. Mr Street said: "The feet should be firm, deep and wide at the heel, not too long or straight in pastern, flat bone, short between fetlock and knee. A stallion should not measure less than 11 inches below knee, and girth from 7 feet 9 inches to 8 feet 3 inches; should not stand more than 17 hands; should have wide chest, shoulders well thrown back, head big and masculine, without coarseness; full flowing mane, short back, large muscular development of the loin, long quarters with tail well set on, good second thighs (this is a point where so many fail), large flat clean hocks; plenty of long silky hair on legs,—or, to sum up in few words, a horse should be long,

low, and wide, and thoroughly free from all hereditary disease. A main point is action: he should be a good mover in the cart-horse pace, walking; and, if required to trot, should have action like a Norfolk cob."

Hair.—Mr Street's reference to silky hair touches upon a remarkable development in the breed. The hair denotes the quality of an animal as accurately as anything else. The suspicion of a curl in the hair of the limbs, or "feather," as it is technically termed, is not looked on with favour. The older type of Shire was a much befeathered animal. The introduction of fine silky hair was coincident with the diffusion of flat bone and the supersession of such stable troubles as grease and Monday morning leg. The American buyer likes as little hair on the limbs as possible. The English buyer objects to its absence. Hence we have warring elements. Whether there is any truth in the contention that, as with Samson of old, the hair denotes strength we do not pretend to assert, but it is a fact that hair goes a long way to obscure defects of knee, cannon-bone, pastern, and hoof.

English and Scottish Notions.—It used to be a trite saying that in judging a horse a Scotsman began with the feet and legs of the animal, an Englishman with its top. By this it is meant that the chief consideration with the Scottish judge is the feet and legs, and with the English the body of the horse. Of both judges there was truth in the statement, and in these habits both were mistaken. It is true, no doubt, as the Scotsman argued, that without good, sound, well-formed, well-set legs and feet to carry and propel it, the best body one could conceive would be of little value. It is equally true, as the Englishman contended, that a horse with a big well-formed body will usually fetch more money in the market than one with a small weak body. Fortunately they have differed and agreed—at least the English breeder has absorbed the whole creed. If a horse lacks foot he has a poor chance of recognition in an English showyard. A short pastern is quickly detected and condemned. But one thing the Shire breeder will never part with is weight. He wants the avoirdupois in the collar to start a load. The Scottish breeder pits against this the superior activity of the Clydesdale. Perhaps the reason for this difference of opinion is found in the fact that London is paved with wood, while the large towns of the north mainly employ stone setts. Weight is especially necessary where there is a bad foothold.

FEEDING AND MANAGEMENT.

Bringing out Shires for Show.—The bringing out of Shire horses for show is now so much a question of the expertness of the individual, that directions, while forming a useful guide, must be applied with all the skill of an expert to be successful. In the choice of suitable young animals for show the "expert" eye is the most necessary agent. In a foal, a big quantity of hair right from the back of the knee should be looked for. The foal that comes out in a naked condition has very little chance to win: therefore cultivate hair. The next things to be looked for are weight, the naturalness of the joints, the openness of the hoof heads and the heels, the quality and set of the limbs. Bad action can sometimes be corrected by judicious shoeing; but when the indifferent action is due to a physical defect, it is impossible by artificial means to correct it, although it may be improved. It is sometimes difficult to determine when a fault in the action is due to weakness and when it is inherent. The writer remembers many occasions when foals have been penalised because of their indifferent action, yet coming out in maturer years with few signs of their earlier defects. The defects sometimes vanish when the young animal gathers strength, when the bones and muscles become set.

Rearing Foals.—In brief, the first thing to do is to choose a type and stand by it. The foal that gives early promise will do well on mother's milk if the dam is doing her duty. The longer that corn-feeding can be staved off the better, as it has a tendency to affect the limbs and joints. If the mare, however, does not nurse the foal well enough, a feed consisting of crushed oats, bran, and chaff once or twice a-day

should be given. The foal will soon eat along with the mare. The quantity of artificial food may be increased as weaning time approaches, usually when the foal is about five months old. There are foals one sees at the foal shows which are dropped in January and February still looking for mothers' milk. It is a strain upon the mare to have her foal suckling too long, and usually those early foals are difficult to keep correct on their joints. They do not have a chance for some months of enjoying a run at pasture, consequently they are very troublesome to the owner. Moreover, they are almost certain to lose their hair, and have a stale appearance ere the September foal shows come round.

Some breeders trust to the milk-pail, sweetening cow's milk and occasionally diluting it. It is a penny-wise and pound-foolish policy. It is never very difficult to detect a foal that has had too much of this kind of treatment. The foal grows by it, it is true, but it gets very shaky about the limbs, goes off its joints, and lacks that fresh brisk appearance characteristic of younger foals with harder feeding.

It is well to get the young foal to start the winter well. A check in the earlier months is a bad preparation for the future. It means at least two to three months lost, and that is a serious handicap when judges are so pronouncedly in favour of big young colts and fillies. Give the weaned foal a companion in the paddock night and day, with a shed for shelter. As a rule, they only use it as a feeding-box. Night and morning a mixture of ground oats, bran, and hay chaff may be given with the addition of linseed-cake and a few carrots. It is better to damp the mixture with warm water prior to feeding. This combination of feeding-stuffs grows bone, assists the coat, and stimulates the appetite. At no time should more be fed than the foal will clean up readily.

Young Horses.—If the young stock are intended for spring exhibition they may, in December, be brought into a loose-box and receive a quantity of long hay as well as the chop mixture, which should be gradually increased in oats and bran. The object is to have the colts handled as much as possible and to accustom them to confinement, which they have to undergo at such shows. It also prevents them taking cold so easily as they otherwise would.

Attention to Hair.—Particular attention should be directed to keeping the hair on. What with rubbing and clogging with mud it is apt to become worn and fragmentary. A good dressing to use is equal parts of sulphur, paraffin, and train-oil, which should be well rubbed in to get to the roots of the hair and also to prevent it running off. The day after the application a sawdust dusting should be given, otherwise the hair will mat and even rot with the adhesions of mud and dirt which young animals delight to walk in. To walk in mud no doubt is cooling to the feet, an important consideration when the food is heating.

Before the animals are brought out, the hair should be carefully cut away above the joints with a sharp knife, and a wet cloth tied round the limb for some time before exhibition to make the hair lie naturally. The "feather" should be carefully washed, and dried with sawdust, and brushed freely. The old practices of soaping and resining are now not recognised by the Shire Horse Society, so that the hair must be naturally straight and silky to do the animal justice.

Attention to Feet.—Another point that must be carefully looked to is the paring of the feet. The hoofs have a tendency to wear down on the outside, and rasping must be the remedy, otherwise the action of the colt may be interfered with.

Grooming and Handling.—Grooming should be regular some time before showing, and great care should be taken to train a young animal to the halter. Find out his best pace at the trot, and keep him to it. An indifferent and slouching walker may need the sharpening of the whip. Again, the action may be improved by the shoeing, the calkins being raised and lowered as desired.

Adult Animals.—In bringing out older animals, the advantages derivable from a run at pasture with shoes off should not be forgotten. A cooling mash is also freely given. Some

exhibitors medicate their horses very freely to stimulate the appetite, but the practice is reprehensible. To get a good coat, sleek and glossy, linseed or linseed-cake should be used in the ration. Maize, boiled and flaked, and saccharine preparations are likewise used for conditioning.

As already stated, the Shire stallion "Birdsall Menestrel" is represented in Plate 12. A portrait of the Shire mare "Pailton Sorais" is given in Plate 13.

CLYDESDALE HORSES.

The Clydesdale is the native Scottish breed of draught-horses. The history of the breed has been often written, and little that is fresh can be said by any writer on that subject.

Origin.—All attempts to demonstrate that the breed sprang from one sire are destined to failure. No breed owes its existence to such a cause. Before the influence of one sire could be regarded as alone responsible for the success of a breed it would require to be proved that the breed had no existence prior to the advent of the sire.

The broad facts connected with horse-breeding in Scotland are not difficult to state. As early as the fifteenth century Scotland was famous for its horses. It did a large export trade with the Continent then, and from time to time Royal edicts were issued regulating that trade. Sometimes exportation was prohibited; sometimes it was carried on subject to a heavy export duty; sometimes it was unrestricted. But however conducted, the fact stands out clear that Scottish-bred horses were coveted by Continental buyers during the long period of the Stuart dynasty. The kings were each after his own manner patrons of horse-breeding, but it cannot be said that this patronage did much to improve the native breed for draught purposes.

The Clydesdale in Peace and War.—The Clydesdale as a draught-horse came into being after wars had ceased, so that men could without molestation pursue the arts of peace. Therefore the history of the draught-horse is pre-eminently associated with the rest which the land enjoyed after the Revolution Settlement in 1690.

This is specially true of the district from which the Scottish breed takes its name. Clydesdale is the old name for Lanarkshire, just as Angus is the old name for Forfarshire, and Tweeddale the old name for Peeblesshire. The name indicates that the home of the breed, in its modern draught type, is to be found in the valley of the Clyde. There the internecine warfare of the later Stuart era was waged with relentless fury, and the very places and parishes associated with the early history of the improved breed are those which formed the theatre of many of the most stirring incidents in the Covenanting struggle. The arts of peace required a horse of a different type from that called for by the exigencies of war. The era of road-making and the era of industrial development in Lanarkshire were contemporary. The industrial development demanded a horse that could pull as well as carry, and the formation of roads on which carts could be pulled created the demand for a heavier horse than the sure-footed nag on which the Upper Ward and Avondale farmer had hitherto relied.

Early Improvement.

Various traditions point to Flemish stallions having been the instruments employed in the work of improvement. There are three traditions of this nature. One credits the sixth Duke of Hamilton (1742-1758) with having kept a dark-brown Flemish stallion at Strathaven Castle for the use of his tenantry. Another speaks of a Duke of Hamilton a century earlier who kept "six fine black stallions from Flanders" there; and a third gives one John Paterson, of Lochlyoch, on the slopes of Tinto, the credit of introducing about the year 1720 a black stallion from England

named "Blaze," which became the founder of the celebrated breed of Clydesdale horses. So the chronicler of these things avers. It may be accepted, therefore, as truth, that outside influences so enhanced the weight and substance of the native breed in Lanarkshire that about the beginning of the nineteenth century they became noted for their properties as draught-horses.

Their reputation extended far afield, and the markets held at Rutherglen, Lanark, and Biggar were frequented by dealers from all quarters, south of the Border as well as north. Mobs of young colts and fillies were drafted from the Lanarkshire breeding-grounds into other areas. The general influence of these importations was towards the extended breeding of animals possessing the Lanarkshire type, so that "Clydesdale" became the trade-mark of a type of horse bred in areas far apart. The name occurs in literature as early as 1823, and could not have been applied in such widespread fashion had the type which it represented not been generally recognised. That type was indigenous to Lanarkshire or Clydesdale, and was not imposed upon the horses of the Clyde valley by any external influence. Such influences imparted properties which enhanced the value of the existing type for draught purposes, but it would not be true to say that the influence of one sire, or of six, created a new type within the Clydesdale area.

An Unfounded Theory.—Attempts have been made to connect the entire modern breed of Clydesdales with one Lanarkshire tribe in a definite and direct way. The theory is that a filly directly descended from the Lochlyoch mares, improved by John Paterson's black stallion from England, became the dam of Thompson's black horse "Glancer" 335, and that the whole Clydesdale race can, through this one link, be connected with the historic tribe. That the whole modern race of Clydesdales is connected with the Lanarkshire race does not admit of doubt, but a close examination of the facts, and especially a comparison of dates, does not warrant the theory that Thompson's black horse was a son of the Lochlyoch-descended Lampits mare—otherwise the Shotts Hill Mill filly. This filly was bought at the displenishing sale at Shotts Hill Mill in 1808. It is assumed in the Retrospective Volume of the *Clydesdale Stud-Book* (published in December 1878) that "Glancer" 335, Thompson's black horse, was her son, foaled in 1810. But Thompson's black horse ("Glancer" 335), on the authority of one who knew him, was the sire of Paton's horse of Bankhead, Yoker, Renfrewshire. This Paton's horse won second prize at the Highland and Agricultural Society's Show at Edinburgh in 1842, when he was six years old. He was therefore foaled in 1836, and, if the entry in the *Stud-Book* is correct, his sire, "Glancer" 335, must have been twenty-five years old when he was got. The travelling-card of Thompson's black horse, which has been reproduced in the second volume of the *Stud-Book* (published in February 1880), is unfortunately not dated, and it tells nothing about his pedigree. It is, however, stated in the Introductory Essay in which that card is embodied (no doubt on good authority) that "Glancer" 335 died when ten years old. Consequently the theory that he was the son of a filly sold at Shotts Hill Mill in 1808 may be dismissed, along with the fabric of pedigree which has been built upon that theory.

Thompson's Black Horse and his Descendants.—Thompson's black horse was a sufficiently noted horse in his time. His service fee was one guinea, with one shilling additional to the leader. He was the progenitor in direct line of "Broomfield Champion" 95, and that horse did quite notable work in fixing for many generations the type of Clydesdale horse. His most noted son was "Clyde," *alias* "Glancer" 153, known as "Fulton's ruptured horse," and through him he may be said to have made the modern Clydesdale breed.

"Clyde," *alias* "Glancer" 153, was a "mickle strong horse." He had seven sons, which made Clydesdale history. These are "Baasay" 21, "Clyde," *alias* "Prince of Wales" 155, "Farmer," *alias* "Sproulston" 290, Erskine's "Farmer's Fancy" 298, "Muircock" 550, "Prince Charlie" 625, and Barr's "Prince Royal" 647. "Clyde," *alias* "Prince

of Wales" 155, "Farmer's Fancy" 298, and "Prince Royal" 647, made their mark in the showyards of the Highland and Agricultural Society, and all of the seven were successful in leaving an indelible impression on the breed as a whole.

If the descendants of these seven sons of "the ruptured horse" were eliminated from the breed, it would be weak indeed. They were not all regular in their breeding as sires, and "Prince Royal" 647 had the gift of breeding some of the best as well as some of the least satisfactory of stock. It is possible his dam was of southern extraction. He bred some stock chestnut in colour, and others having a tendency to roundness of bone. Generally, however, the stock descended from Fulton's "ruptured horse" conformed to the standard set by his owner, William Fulton, and were of the "razor-legged" type. By these seven horses and their direct descendants, in a marked degree, was the Clydesdale type which dominated the show-ring for about thirty years, from 1850-1880, determined.

Other influences began to make themselves felt from about 1880 and onwards, and in the end a type, especially in respect of formation of feet, obliqueness of pastern, and hardness of bone, was evolved which controls the Clydesdale world to-day.

Spreading of the Breed.

Other horse-breeding districts were so influenced by these sires and their descendants, and by other sires imported from Clydesdale, that the stock reared within these areas bore the same name. The Clydesdale influence can be directly traced in districts so widely separated as Galloway, Cumberland, Kintyre, and Aberdeenshire.

Galloway Horses.—The native breed of horses in Galloway had a character of its own—which has obtained renown in history, poetry, and romance. To this day the town of Inverness is the scene of races in which horses called "Galloways" are included. Writers of parish records in the province of Galloway have left descriptions of horses bred in Galloway, prior to the introduction of the Clydesdale, about the beginning of the nineteenth century. One of the most noted of these writers is the Rev. Samuel Smith of Borgue, whose *Survey of Galloway* was published in 1810. He writes eloquently concerning the merits of the old Galloway nag, and shows how the demands of an improved agriculture led, by judicious selection, to the improvement of the native breed. They were, he says, deservedly held in high estimation for the purposes of husbandry. They were "round in the body, short in the back, broad and deep in the chest, broad over the loins, level along the back to the shoulder, not long in the legs, nor very fine in the head and neck. Their whole appearance indicated vigour and durability, and their eye commonly a sufficient degree of spirit." Mr Smith admits that they were inferior in size to the dray horses of many other districts, but were not inferior in respect of capacity to perform labour or endure fatigue. These horses were, according to Mr Smith, improved by the use of sires from England, Ayrshire, and Ireland, and the Clydesdale influence from Lanarkshire was imposed upon the product of this union.

Improving the Breed in the Stewartry.—The Stewartry of Kirkcudbright began early to improve the breed of native horses by hiring stallions from Lanarkshire. Two of the earliest recorded sires so hired were "Samson" 1288, foaled in 1827 or 1828, and his grandsire, "Smiler," which must, therefore, have been foaled early in the nineteenth century. Since that date, in unbroken succession, Clydesdale sires were hired for service in the Stewartry, and the breeding of Clydesdales there received an additional impetus when representatives of the Muir family migrated from Sornfallo, on the slopes of Tinto, in Lanarkshire, one of them to Maidland, Wigtown, the other a few years later to Banks, Kirkcudbright. The blending of blood taken into Galloway by them produced in a later day "Lochfergus Champion" 449. A later blending of the blood of that horse with that of native mares in the parish of Twynholm gave the Clydesdale world "Conqueror" 199, the sire of "Darnley" 222.

Early Improvement in Wigtownshire.—Wigtownshire was early engaged

in importing and hiring stallions from Lanarkshire. The horse "Clydeside," credited with being the sire of Agnew's "Farmer" 292, could hardly have borne that name had he not been of Clydesdale origin. The Dumfries Highland Show of 1830 marked an era in the history of the breed. At it "Farmer" 292 gained a premium of £30 from the Highland and Agricultural Society. The late Colonel M'Douall of Logan was a spirited exhibitor of Clydesdales at that period. He had a formidable rival in Mr Robert Anderson, Drumore, Kirkmaiden, who, in 1835, made a historic tour into Lanarkshire and Renfrewshire, the history of which is given in the Retrospective and second volumes of the *Clydesdale Stud-Book*. The Clydesdale of the latter half of the nineteenth century was the direct result of the blending of these two streams of breeding in Galloway. Horses, the product and descendants of the Lanarkshire importations of 1835, travelled in the Kirkcudbright area for many seasons, and the strong family likeness and fidelity to one type of their produce ensured the success of almost any sire with which they might be mated. When the selected sires happened to be bred very much on the same lines as the native mares, as in the case of "Darnley" 222 and his descendants, the results went to the making of Clydesdale history.

The Breed in Kintyre.—Kintyre enjoys all the advantages of an insular position without actually being subject to its disadvantages. The history of the importation of the Lanarkshire breed into the peninsula is fortunately very clear. The native breed would no doubt be of Highland origin. The first operating source of improvement was the importation of Lanarkshire stock by the laird of Lee in Carnwath parish, Lanarkshire, who also owned Largie estate in Kintyre. One horse in particular, bearing the local title of Lockhart of Lee's black horse, had quite a good reputation, and the tradition connected with his name survived up to the time when tradition gave place to record by the establishing of the *Clydesdale Stud-Book*.

On account of the geographical formation of the district the record of improvement can be clearly traced. It is prior to 1878 associated with a succession of horses, the principal of which are "Farmer's Fancy" 298, "Rob Roy" 714, "Largs Jock" 444, "General Williams" 326, and "Lorne" 499. The influence of these horses for good can be traced with considerable clearness, as can also their defects. "Farmer's Fancy" 298 had "boxy" feet and upright pasterns, and that defect long persisted in the Clydesdales of Kintyre. "Rob Roy" 714 had very good feet and legs, but his back was hollow, and he was locally known as the "laigh-backit horse." "Largs Jock" 444 was a good horse with excellent feet, but his hind legs were too straight. He was locally known as the "straight-legged horse." "Lorne" 499 was a horse with a splendid top and well-sprung ribs, but he lacked spring and length of pasterns.

Other sires came and went to Kintyre for a season, but the aforementioned travelled in the peninsula for several years in succession. Consequently they, and not the premium horses imported in later days, dominated the type produced in Kintyre. As far as prize-winners are concerned, "Rob Roy" and "Largs Jock" made the best mark.

The Clydesdale in Cumberland.—Cumberland, from its geographical position, is a county in which a struggle for the mastery between the northern and the southern breeds of draught-horses might be looked for. To a certain extent this took place, but when the matter is examined closely it is found that there is a much stronger admixture of Clydesdale blood there than of any other. Good Shire horses have from time to time travelled in Cumberland, but the records of the Clydesdale Horse Society show clearly that the Clydesdale element predominated in the native horses.

The links between Lanarkshire and Cumberland are clearly established. The first can be traced back to "Old Bay Wallace" 572, bred in Ayrshire and foaled in 1827; "Old Stitcher" 577, bred in Dumfriesshire prior to 1815, probably about 1810; and Pringle's "Young Clyde" 949, the most impressive of all the old Cumberland sires. He was bred at Hyndford Bridge, Lanark, in 1826, and was a horse of great size

and strength. He lacked depth of rib, but was big and well coloured, and as he lived long he moulded the Cumberland type along Clydesdale lines.

Of Shire horses that travelled in Cumberland one deserves special mention because of his having also for two seasons travelled in Ayrshire. This is "Farmer's Glory," owned in Ayr by Andrew Hendrie, horse-dealer, and in Cumberland by John Robinson, Wallacefield. He won a £50 premium at Ayr in 1857, and left good stock, his female progeny far excelling his males. In this respect he resembled another excellent Shire horse, Mr Alexander Galbraith's "Tintock," which won second prize at the Highland and Agricultural Society's Show at Glasgow in 1867, and the Strathendrick premium. Both of these horses did good service in improving the breed, but curiously enough their influence did not continue into their second season in Scotland.

The Clydesdales in Aberdeenshire.—Aberdeenshire, like Cumberland, had to some extent a mixed breed of mares to begin with. Clydesdale sires from Lanarkshire were taken north as early as 1823. One of them was "Young Glancer," supposed to have been a son of Thompson's black horse, but it is doubtful whether a rigid application of the age test would support this theory. Other horses bearing names suggestive of Clydesdale lineage were "Young Champion of Clyde," foaled in 1840; "Farmer's Fancy," foaled in 1847; and "Justice" 420. The Earl of Kintore, Inglismaldie, and the well-known Captain Barclay of Ury, were owners of horses whose reputations survive. The horses which live, however, and fairly put the Clydesdale mark on the draught-horses of Aberdeenshire, were "Grey Comet" 192 and "Lord Haddo" 486. They were both prize-winners at the Highland and Agricultural Society's shows, and being horses of sound constitution, as well as of true Clydesdale character, they stamped their own image on the horses of the northern counties.

The Clydesdale Horse Society.

The Clydesdale Horse Society was formed in June 1877, and the first volume of the *Clydesdale Stud-Book* was issued in December 1878. These institutions owe their existence chiefly to the enterprise of the late Earl of Dunmore and Mr John M. Martin, now residing at Lasswade, Mid-Lothian. The Earl of Dunmore was instrumental in securing the support of 100 Life Governors, who subscribed £10, 10s. each to the funds of the Society at the outset, thus giving it a unique start. Mr Martin was at that time tenant of Auchendennan Home Farm, and Hawthornhill, Dumbartonshire, and owned several of the best Clydesdales of their time.

The initial work connected with the Society was carried through by these gentlemen and a Council and Editing Committee, on which were the late Sir William Stirling Maxwell of Keir and Pollok, Bart., the late Sir Michael R. Shaw Stewart of Greenock and Blackhall, Bart., and other gentlemen keenly interested in Clydesdales. They had as their secretary, from 1877 to 1880 inclusive, Mr Thomas Dykes, who was also Agricultural Correspondent for the *Glasgow News*. In the latter year the office of secretary was filled by the appointment of Mr Archibald M'Neilage, who has rendered valuable services to breeders of Clydesdale horses, and to whom we are indebted for this sketch of the breed.

Infusion of Shire Blood.—A primary difficulty had to be encountered. For many years prior to 1877 an occasional Shire horse or mare had been imported from England, and in several cases, as has already been indicated, good results had followed from blending the two races. A small but influential body of breeders, led by the late Lawrence Drew, of Merryton Home Farm, Hamilton, indulged the idea that there should be but one Stud-Book for the English and Scots breeds, and refused to join the Clydesdale Horse Society. They maintained an attitude of opposition until the lamented death of Mr Drew in March 1884.

Standards for Admission to Stud-Book.—The difficulty was to fix a standard of admission into the *Clydesdale Stud-Book*, which while conserving the distinctive character of the Clydesdale breed, would not disqualify a large num-

ber of animals, true to Clydesdale type, in which there was admittedly a strain of Shire blood.

The standard fixed for the Retrospective volume, which included stallions foaled prior to 1st January 1875, was to recognise all stallions reputed to be Clydesdales, which were dead when the Stud-Book movement commenced, as such, and to recognise as Clydesdales all stallions foaled before the date named and then living, if got by a recognised Clydesdale sire or out of a mare got by such a sire. This disqualified a number of horses, such as Hendrie's "Farmer's Glory" and Galbraith's "Tintock," already named, because their pedigrees were given and known as Shire.

For horses foaled on or after 1st January 1875, the standard was made, registered sire and dam got by registered sire, and a similar standard was set for mares foaled on or after 1st January 1877. The policy then outlined of proceeding cautiously, and not making rules more stringent than Nature admits of in her reproductive functions, has been stedfastly adhered to.

For several years the standard has been registered sire and registered dam, or registered sire and dam having herself two registered crosses.

Practically the whole of the Clydesdale breeding interest now supports the Stud-Book movement. The membership of the Society in 1908 numbered about 1500. In the first thirty volumes of the *Stud-Book* there are 14,432 entries of stallions, and 20,650 entries of mares.

Characteristics.

The Clydesdale has undergone modification in type at the hands of man during the past century.

Ancient Types.—Portraits of a mare named "Meg" and a stallion named "Young Clydesdale," which won at the Highland and Agricultural Society's Show in 1826, represent the mare to have been a big handsome animal with clean hard bones, good round hoofs, and well-sprung pasterns. She looks a big mare, standing possibly 16.2 hands, with a well-set-on head and neck and high withers. The feature which distinguishes her from the Clydesdale mare of the present day is her somewhat "gyp" appearance. "Young Clydesdale" appears to be a much lighter animal, shown in plough harness. He would be regarded now as rather much of a "van" horse.

About the year 1840 and onwards the demand was for a thick, wide, low-set horse, with strong forearms and thighs, broad bones, plenty "feather" on his legs, and not too much spring of pasterns. The feet were always an essential point in the Clydesdale, and at no time can it have been a matter of indifference with breeders as to the wearing quality and openness of hoof-head of the Clydesdale horse.

Action about the year 1860 reached its highest illustration in the stallion "Sir Walter Scott" 797, which won first in that year at the Highland and Agricultural Society's Show at Dumfries, and first at the International Show at Battersea in 1862. In 1870 "Rantin' Robin" 685 beat "Prince of Wales" 673 at the next Highland Show at Dumfries. His pasterns were short and upright, but he had a clear advantage over his rival in respect of the breadth and openness of his face, and his grandly rounded barrel, with deep ribs.

Favourite Type in 1850-1880.—The Clydesdale stallion of the period from 1850 to 1880 was generally a horse standing from 16.2 hands to 17 hands, with good open-hoofed feet; pasterns not too oblique; broad flat bones, fringed with plenty of hair; broad hocks, not too straight; well-developed forearms and big knees, broad in front; good walking action and moderate trotting action. Colours were mostly browns, bays, or blacks, with an occasional grey among the mares, but chestnuts were anathema. Only one really good chestnut horse was seen during that period, "Topsman" 886, and while his breeding on the sire's side is undoubtedly Clydesdale, dispute was keen as to his dam. His granddam was bought in Glasgow market in foal to a horse called "Samson" (so it was said), but the "Samson" was never identified. The foal was "Topsman's" dam.

Prince of Wales.—The sire which modified this type was "Prince of Wales" 673, foaled in 1866. He lived until the

autumn of 1888, when he died in the possession of his first owner, Mr David Riddell, Blackhall, Paisley, who bought him at Mr Drew's dispersion sale at Merryton in April 1884 for 900 guineas. "Prince of Wales" was an upstanding, tall horse, with rather a hard "Roman nose," and somewhat straight hocks. He was marvellously healthy and sound. He could trot like a Roadster, and imparted much greater style to the Clydesdale than the breed had possessed up to this time.

Darnley.—His great rival, and in the end his stable companion, was "Darnley" 222 (1872-1886). He was a more regular and impressive sire than "Prince of Wales" 673. If the head of the latter was rather long and narrow, the head of "Darnley" was rather small and pony like. He had slightly drooping quarters, but otherwise he was the ideal Clydesdale. He was a magnificent walker, but lacked the dash and vim of the "Prince of Wales" strain. When on his season in the year 1882 he weighed a ton (2240 lb.)

Stock of Prince of Wales and Darnley.—The "Prince of Wales" mated with mares by "Darnley" produced some of the highest priced Clydesdales on record, including "Prince of Albion" 6178, sold when two years old for £3000 to Sir John Gilmour of Montrave, Bart.; his own brother, "Prince of Kyle" 7155, sold when rising two years old to the late Mr James Kilpatrick, Craigie Mains, Kilmarnock, for £1700; "Prince Alexander" 8899, sold when a foal, not twelve months old, to the late Mr James Lockhart, Mains of Airies, Stranraer, for £1200. Sons of "Darnley" also made high prices, and many of them were the best breeding horses of their time. As sires they bred with greater uniformity than did the sons of "Prince of Wales" 673. "Topgallant" 1850 was sold when rising four years old to the late Sir Michael R. Shaw Stewart, Bart., for £1600, and "Flashwood" 3604 was sold when one year old to Mr John Pollock, Langside, for £900.

A New Era—Measurements of Clydesdales.

Sir Everard.—A new era in Clydesdale breeding began with "Sir Everard" 5353, a son of "Topgallant" 1850, and out of a mare by a son of "Prince of Wales" 673. He was foaled in 1885 and died in August 1898. He stood fully 17.1 hands, girthed, when in low condition, 8 feet round the heart, and weighed, in June 1890, 20¾ cwt. He measured round the forearm, above the knee, 26 in.; 17 in. round the knee; 11 in. bone immediately below the knee; 12 in. bone immediately below the hock; 11½ in. from the centre of the knee to the centre of the fetlock joint; 21½ in. from the stifle joint to the point of the hock; and 18½ in. from the point of the hock to the hind fetlock. He mated very successfully with mares got by "Prince of Wales" 673, or mares by sons of "Darnley" 222.

Baron's Pride.—"Sir Everard's" most celebrated son is "Baron's Pride" 9122, foaled in 1890, and still alive (1908). Without cavil, this is the greatest breeding horse the Clydesdale race has known. He stands 17.2 hands, and in show bloom, in 1894, when he was champion of the show of the Highland and Agricultural Society at Aberdeen, he girthed 8 ft. 2 in. "Baron's Pride" is represented in Plate 10. His son "Silver Cup" 11,184, with a prize record exceeding that of his sire, and still alive, stands 17 hands. In November 1905 "Silver Cup" girthed 8 ft. 1 in. He measured 17 in. round the forearm, and 19 in. round the gaskin. He had then 10½ in. bone below the knee, and 12 in. below the hock. At the date named he weighed 2156 lb.

"Baron of Bucklyvie" 11,263, the first prize aged stallion at the Highland Show at Aberdeen in 1908, was foaled in 1900. When five years old he stood 17.2 hands, and girthed (in November 1905) 7 ft. 2 in. Around the forearm, 1½ in. above the knee, he measured 15½ in., and 18½ in. round the gaskin, about 1½ in. above the hock. He measured 10½ in. bone below the knee, 11 in. bone below the hock, and at the date named, in low condition, weighed 1876 lb. The corresponding measurements for "Sir Hugo" 10,924, when seven years old, and in lean winter condition, were: height 17.1 hands, girth 7 ft. 3 in., 15½ in. round the forearm, and 18 in. round the gaskin, above the hock; 10½ in. bone below the knee, 11¾ in. bone

below the hock; weight when on his season travelling in 1905, 1950 lb.

Hiawatha.—Passing from the "Sir Everard" tribe, to which all of these horses whose measurements have been given belong, the most notable show horse of modern times is "Hiawatha" 10,067 (Plate 9). Four times he won the Cawdor Cup for the best Clydesdale stallion at the Glasgow Show, and he was awarded the supreme championship of the breed at the Highland and Agricultural Society's Show at Edinburgh in 1899. He belongs to the most modern type of Clydesdale, and has more of "Prince of Wales" 673 character in him than any other horse of his time.

In November 1905 "Hiawatha" stood 17.2 hands, girthed 7 ft. 6 in. in lean condition, and then weighed 2128 lb. His bone, below the knee, measured 10½ in., and below the hock, 11 in. His son, "Hiawatha Godolphin" 12,602, was foaled in 1902, and when three years and four months old stood 17.2½ hands, girthed 7 ft. 6½ in., and weighed 1960 lb. Below the knee his bone measured 10½ in., and below the hock 11¾ in. He measured 17 in. round the forearm, and 19½ in. round the gaskin above the hock.

"Marcellus" 11,110, another son of "Hiawatha," was foaled in 1898, and in November 1905 he stood 17.1½ hands, girthed 7 ft. 8 in., and weighed 1988 lb. He had 16½ in. muscle above the knee, and 19½ in. round the gaskin, above the hock. He had 11 in. bone below the knee, and 12¼ in. bone below the hock.

Royal Favourite.—Of a different type and of another line of breeding, but still combining "Prince of Wales" and "Darnley" blood, is "Royal Favourite" 10,630. He was foaled in May 1897, and in November 1905 stood 16.2½ hands, girthed 7 ft. 3 in., and weighed 1960 lb. He has 16 in. above the knee, 18 in. above the hock. Bone below the knee 10 in., and below the hock 12 in.

Measurement of Mares.—Mares may be taken as a rule to measure about 2 in. less in height, from 15.2 to 16.2 hands being the average. And in respect of weight of bone and other measurements, these are in proportion. "Chester Princess" 16,371, the champion mare at the Highland Show for two years, is considerably over these measurements, and in proportion in every respect.

Features of the Modern Clydesdale.

A Clydesdale, whether male or female, must walk close behind—that is, the points of the hock must be turned towards each other, and they must not be too open in the thighs. In front, their legs should be planted well under the shoulders and chest, and not at all on the outside, like those of a bulldog. It is a very bad fault for a Clydesdale to stand "easy" on its forelegs, so that its knees are shaky.

A true Clydesdale gives the ideas of strength, spirit, and soundness. Activity is essential, along with soundness of wind and limb.

Markets for Clydesdales.

Export Trade.—The Clydesdale has long been in great demand for foreign export. As early as the second quarter of the nineteenth century stallions and mares were being exported to the Australian colonies and to Canada. During the next quarter of the century Australia and New Zealand bought many of the choicest specimens of the breed, and prices over £1000 were recorded for horses like "Time o' Day" 875; "Pride of Scotland" 602, the best two-year-old colt of 1874 went to Australia at £750, and his son "Bonnie Scotland" 1076 followed in 1878 at £900.

Many Highland Society first-prize winners were exported from 1850 to 1880, and although the volume of trade in any single year might not have gone much, if any, over a score, the value of each animal was high.

In 1880 a totally different trade was developed with the United States and Canada. Numbers rather than quality were its characteristic, although this rule did not universally apply. In 1881 a large number of the best females at the shows of that year went to the United States and founded studs there from which valuable animals have since been brought back to Great Britain.

Export Certificates.—In 1884 the Clydesdale Horse Society began to keep accurate records of the Export Certificates

issued, and the following list indicates what these were:—

Year.	No. of Certificates issued.
1884	500
1885	514
1886	600
1887	920
1888	1149
1889	1040
1890	554
1891	349
1892	158
1893	110
1894	21
1895	15
1896	56
1897	57
1898	132
1899	250
1900	178
1901	167
1902	266
1903	411
1904	536
1905	653
1906	1317
1907	1100

Home Market. — With respect to values in the home market the following tables of averages show the rise and fall in prices over the period from 1876 until 1908. It will be observed that the average made at the Knockdon sale of 1876 has only once been surpassed during the generation that has passed away since it was held:—

Clydesdale Sales from 1876 *to* 1908.

The following is a list of the average prices obtained at the leading public sales of Clydesdale horses from 1876 to 1908:—

Place.	Nos.	Average.
1876.		
Knockdon	22	£209 15 2
1878.		
Merryton (partly Shire and Crosses)	50	168 11 0
1879.		
Merryton (partly Shire and Crosses)	55	112 11 0
Auchendennan	13	114 5 9
1884.		
Auchendennan	14	161 14 6
Merryton (Dispersion, partly Shire and Crosses)	63	152 3 0
1887.		
Whitehill, Sanquhar (Mares only)	11	138 18 2
1892.		
Montrave (highest, Queen of the Roses, two-year-old filly, 1000 gs.)	29	£149 15 0
1893.		
Croy-Cunningham	19	88 12 10
Blairtummock	31	51 1 6
Kippendavie	25	48 2 0
1894.		
Mains of Airies	32	80 9 1
Edengrove and Robgill (Joint)	23	77 15 10
Craigie	20	26 11 3
Seaham Harbour (Draft)	42	36 2 6
1895.		
Eastfield (Stallions only)	38	168 8 10
Glasgow Cattle Market (Mares only)	10	68 19 8
Earnock	27	79 5 10
Polmont (Joint)	39	60 15 10
1896.		
Sinclair Scott's (Glasgow)	29	63 5 0
Lochburn	12	43 5 5
Edengrove (Carlisle)	16	116 19 8
Blairtummock	19	52 3 4
Keir (Dispersion)	53	67 11 6
Seaham Harbour (Draft)	52	41 12 1
1897.		
Moncreiffe	10	44 10 0
Seaham Harbour (Draft)	41	49 5 8
1898.		
Kippendavie	30	48 16 2
South Acomb	38	45 13 0
Seaham Harbour (Draft)	47	48 11 1
1899.		
Overdale (Mares)	7	83 8 0
Morton Grange	38	10 8 0
Seaham Harbour (Draft)	67	48 11 5
Mertoun	18	45 0 8
1900.		
Kippendavie	11	83 2 10
Balmedie (Dispersion)	18	110 6 2
Seaham Harbour (25 Foals)	61	52 18 5
South Acomb	37	40 17 7
1901.		
Milton Ardlethen (Females only)	11	45 5 8
Mains of Airies (Dispersion)	19	141 7 9
Morton Grange	36	74 18 7
Seaham Harbour (Draft)	53	42 3 11
Perth—Montrave	23	64 16 6
Blairtummock	5	61 6 5
Rosehaugh	10	47 2 11
Orchardmains	10	44 4 1
Glamis	4	45 8 3
Sands (Fillies)	2	51 9 0
Cavens	22	44 2 0

Place.	Nos.	Average.
1902.		
Bellsfield	6	£66 10 0
A. B. Matthews (Draft)	4	73 4 9
Seaham Harbour (Draft)	38	53 16 0
Millfield	16	77 6 1
Seaham Harbour (Draft)	32	39 15 8
Lambton	36	47 15 2
1903.		
Swinton House	18	46 10 6
Orchardmains (Dispersion)	24	76 9 6
Milton Ardlethen	19	50 1 11
Morton Grange	20	62 4 3
Seaham Harbour (Draft)	43	44 5 7
Drumflower	9	134 12 8
Garthland	11	45 11 8
1904.		
Seaham Harbour (Draft)	37	45 5 4
Perth—Glamis	9	56 0 0
Rosehaugh	9	42 0 0
Mertoun	13	38 0 0
Mersehead (Pilkington's)	19	47 4 0
1905.		
Blacon Point (at Lanark)	30	152 3 7
Charleston	20	38 18 0
Seaham Harbour (Draft)	45	35 1 0
1906.		
Perth	43	60 16 4
Seaham Harbour (Draft)	39	50 15 0
Blacon Point (at Lanark, Dispersion)	14	216 10 6
1907.		
Scotstoun (A. B. Matthews)	5	84 17 0
Challoch (Newton-Stewart)	12	73 2 1
Perth (Gross)	74	83 5 5
Same Detailed—		
Harviestoun	15	149 17 5
Bullion	3	107 2 0
Mertoun	12	67 12 9
Nether Bogside	5	69 1 9
Mains of Edzell	5	55 10 0
Arnprior (Yearling Fillies)	5	56 18 2
Lochlane	2	93 19 6
Seaham Harbour (Draft)	57	38 1 6
Lambton	40	39 8 8
1908.		
Ardimersay (at Ayr)	6	40 15 6
Perth (Gross)	84	54 5 0
Same Detailed—		
Mains of Edzell	3	55 13 0
Jordanstone	2	136 10 0
Ledlanet	12	74 16 3
Dunure Mains	5	38 8 7
Harviestoun	9	120 19 8
Crieff	5	26 13 5
Mertoun	5	24 15 7
Bullion	4	71 18 6
Seaham Harbour (Draft)	53	45 10 6

MANAGEMENT OF CLYDESDALE STUDS.

The system of management pursued in Clydesdale studs varies to some extent according to the district. In the extreme south-west of Scotland, for example, where the temperature is comparatively high even in winter, it is possible to have the animals out in fields practically all the year round. In such circumstances all that is required is a shelter-shed or some such structure for providing cover in a specially cold or stormy day. In other parts, on the other hand, winter-housing to a greater or less extent is almost a necessity, especially in the case of mares. Young colts running rough may do with a warm shed for use at nights and on cold days, but mares require comfortable housing at that season of the year if colds and other troubles are to be avoided, and the best foaling and other results obtained.

Apart from this, there is no great difference in the methods of treatment between north and south, although naturally where the winter is open and grass comes early in the spring, it is possible to bring out young stock earlier in the year for show purposes. Open-air rearing in winter, especially where the climate is moist, is also a great aid in the growth of hair. This circumstance explains to a considerable extent why young horses reared, say, in Wigtownshire, have usually a greater profusion of hair in the spring than those reared in Lanarkshire, Perthshire, or Aberdeenshire. Later in the year the two classes compete on fairly equal terms in this respect.

Brood Mares. — The treatment of brood mares is perhaps the most important element in stud management. Where mares are kept exclusively for breeding purposes, the artificial feeding should be of the lightest possible description consistent with keeping them in fresh breeding condition. In one very eminent stud in Central Scotland the custom a few years ago was to give the mares of this class only one bushel of oats per head per week mixed with chopped oat-straw, a few swedish turnips in the forenoon, a pailful of boiled food—turnips, cut hay, and bran—in the afternoon, and long oat-straw *ad lib.* Very excellent results were obtained on this feeding for

a considerable number of years, the mares going out in sheltered fields all day, summer and winter. Of late years there has been a tendency to restrict the boiled food and to give everything cold, as being less liable to set up colic. In an equally well-known Fifeshire stud, where as many as fifteen mares were wont to be kept for breeding purposes alone, the custom was, and still largely is, to give the mares twice daily in winter bruised oats and chopped hay along with a few raw swedish turnips. The daily allowance of the combined oat and hay mixture was about 14 lb. per head, one half being given in the morning and the other half in the evening during the period from the end of September until the grass came in the spring. In summer the animals got nothing but grass.

In a Wigtownshire stud, where seven mares were formerly reserved for breeding purposes, the regulation winter diet was 6• lb. of crushed oats and 1½ lb. bruised linseed-cake each per day, with as much timothy hay as the animals cared to eat,—this being in addition to what they picked up in a rough pasture. In this stud rock-salt was always kept within reach of the mares, and this is a course that should be generally followed. Salt not only sharpens the palate of animals but helps to keep them in good general health. An Aberdeenshire breeder gives his breeding mares in winter 1 lb. of oats daily along with cut hay, a boiled mash, and a few turnips; while a Forfarshire breeder gives from the end of October onwards one feed of oats in the morning and a feed of boiled barley and beans at night, in addition to hay and straw and what the mares pick up on the field during the day.

These instances afford an indication of the lines followed generally in the feeding of brood mares kept exclusively for breeding purposes. The important point is to keep the animals in as fresh natural condition as possible, so that they may breed regularly and produce strong healthy foals.

Possibly the greater number of mares are kept for working as well as breeding, and in these cases somewhat different methods of feeding and management have to be adopted. A mare that is working will always require more liberal treatment than one that is doing nothing. Up to about a month before foaling the working mare can be fed on pretty much the ordinary horse rations of the farm—that is, 10 to 14 lb. of grain can be given along with a few swedish turnips, and possibly a bran mash on Saturday nights, with, of course, straw or hay as required. Some people also give an occasional feed of linseed, while others give a two-ounce dose of Epsom salts at least once a-week. About a month before foaling it is usual to reduce the oats and increase the bran or linseed ration. Mares in foal must at all times be worked with special care. They should be backed as little as possible, and for two months at least before foaling they should not be carted. In chains, however, they can be wrought quite safely, up practically to foaling time, provided that they are not hurried and get their own time in turnings and other awkward positions.

Mares worked fairly regularly make the most reliable and satisfactory breeders. They have also, as a rule, the easiest foaling time, and produce the strongest, most thriving, and healthy foals. Idle mares are very apt to get fat no matter what is done to prevent it, and when such is the case foaling risks are greatly increased. Working mares, of course, require careful handling, but where this is given there are fewer losses, as a rule, with mares of this class than with those that go idle. Mares that are hard worked and mares that are highly fed are usually the most difficult to settle in foal. Stallion owners on this account prefer, where they have a choice, districts away from towns, where neither the work nor the feeding is heavy.

Foaling.—In Scotland, at any rate, the bulk of the foaling has necessarily to be done under cover. Several experienced stud-owners never allow their mares to foal in the open before the middle of June in any case. For inside foaling a roomy loose-box is almost a necessity. Mares should be sheeted for a day or two after foaling, and fed on soft, sloppy food, such as boiled barley, pulped turnips, or cut hay mixed with moistened or boiled meal. Bean-meal is regarded as being about the best for this purpose.

Care of Foals.—Perhaps no young animal on the farm is more precarious to handle for the first few days of its existence than a foal. Immediately a newly-born foal gets to its legs it should be taught to suckle its dam. Many mares, even at best, are poor nurses, and it will be the business of the attendant to see that the foal is getting the nourishment it requires. Mares that foal early and have little nourishment for their offspring should be fed as much as possible on sloppy food, and given occasionally a meal-drink. On the other hand, there are mares which have milk so plentiful and so strong as to cause diarrhœa in the young foal. This is an evil to be guarded against. In such cases the mare should be at once put upon dry concentrated food and straw fodder; if at grass, she should be put on the oldest and driest pasture available, and kept there until the flow of milk ceases somewhat in volume. In obstinate or rather over-milky conditions it may be necessary to systematically drain off some of the milk by hand.

Great care should be taken in the choice of a day for turning out the mare and foal for the first time. The selected day should be dry and the grass free from white frost. For the first eight or ten days, should rain begin to fall, the mare should be at once sheltered. A young foal, if exposed in such weather, may contract joint-ill and other diseases, and the mare herself may become chilled. Even after the foal gets older, it is sound policy never to let it out when there is hoar-frost on the ground until at any rate it has had a meal in the house.

Foals are usually weaned when they are from four to six months old. In special cases they may be allowed to go the full six months or even a little longer with their dams, but that involves a good deal of strain on the mare if she is again to have a foal next year, and most breeders are content when they get foals eighteen weeks with the mare. Foals just taken from their mothers should be put in a field or paddock by themselves and given a little artificial food,—nothing is better for keeping the flesh on a foal than a chop mixture of oats, cut hay, and beans, fed twice a-day. Most breeders feed both the mare and the foal before they are separated, for by October, when most of the weaning takes place, the pastures are beginning to get dry and bare. The foal in such cases is accordingly accustomed to eat out of a box before it is weaned, and thus it takes readily to the new conditions, and does not lose condition. If it be important to keep on the "calf" flesh, it is equally important, if ground is not to be lost, to keep on the "foal" flesh. A foal neglected at weaning time or earlier never grows to the size that it otherwise would.

Putting Mares Dry.—As a rule, no difficulty is experienced in getting the mare dry, but where such is the case a doze of 4 drachms of aloes, along with a pint of linseed-oil, has been found beneficial. In extra difficult cases part of the milk should be drawn off at extending intervals and the udder bathed with vinegar.

Other Classes.—The "other classes" in a Clydesdale stud will include colts and fillies of various ages up to three years, by which time the fillies should be qualifying for the brood-mare stage. It is desirable in rearing young horses of this class to run the colts separately from the fillies. In each case the fields or pasture outruns should be equipped with warm wooden sheds fitted with both feed-boxes and hay-racks. Where the animals come into the steading at night warm sheds can be dispensed with, although shelter-sheds, with their faces to the south, may still be desirable. "Chop," as already noted for foals, forms an excellent winter food for young horses of either sex, and this should be accompanied by a few swedish turnips and what long hay or straw they will take. In some studs as much as 10 lb. each animal of chop is allowed per day, but this will depend on the nature of the weather and the character of the pasture. For animals that are being pushed on for showing in the ensuing season, a daily mash of bran, pulped turnips, and barley or beans, with a few raw carrots, are very useful, as are likewise a few green tares, the young animals eating the latter even more readily than hay.

Colts that are not good enough for breeding purposes should be castrated, at the very latest, before they are two

years old. Preferably, this operation should not be delayed beyond twelve to fifteen months. Colts left too long entire become coarse about their heads and necks, and too rough about their legs, to make first-class geldings. Moreover, they never settle or thrive so well as colts castrated earlier. Colts intended to be left entire require to be boxed at two years old. By this time, however, they are usually in the hands of the regular stallion owners, who have premises specially suitable for this class of stock.

Although a few breeders put their fillies to the horse at two years old, the general custom is to leave them until they are a year older. Fillies served at two years old, unless they are extra big in size, are apt to become stunted in their growth, and rarely make such big mares at four or five years old as they would otherwise do. At the same time, many people hold that a filly served at two years old, like a heifer started to breed at fifteen months old, breeds more regularly and with greater certainty in subsequent years than one that is not served until she is three years old.

Management of Show Stock.

Showing is to a considerable extent a business by itself, and in its highest form at any rate not for the amateur. To win a prize in important shows, an animal must, in the first place, be fairly perfect in shape and correct according to the ideas of the time in its detailed points. It must, for instance, be of fair size, as clean as possible in its legs and ankles, and sound in its feet. Moreover, it ought to be a good, straight mover, both behind and in front. More or less solid reasons can be advanced for each of these requirements, and in addition it must be brought out in what is called show form. The latter, assuming that the fundamental groundwork is right, is mainly a matter of physical labour and judicious feeding.

Where the science comes in is in regard to detailed points. Thus blistering is pretty extensively resorted to for the growth of hair over the hoof heads. In the same way many animals are made to stand on soft, prepared stances to encourage the growth of their feet. While most of these devices are perfectly legitimate and harmless so far as the general public are concerned, there is another practice that has crept in of late years that cannot be so well defended,—that is, to force out young animals, colts especially, with cow's milk. By this means it is possible to have big lustrous-looking yearlings with great hair; but animals so forced rarely do much good in succeeding years when the milk-supply is not forthcoming, and the custom of using milk in this way has been blamed for encouraging the objectionable disease known as wind-sucking. The rush for prizes is, however, so keen that expert show men usually use all means open to them to present their animals in the best possible prize-winning form.

The great majority of breeders are wise enough to avoid all these dubious methods, and to rely upon more natural means of embellishment, which, after all, pay best, and are in every respect most satisfactory in the end.

Clydesdale stallions are represented in Plates 9 and 10, and a Clydesdale mare in Plate 11.

THE SUFFOLK HORSE.

The Suffolk Punch is a distinct type of horse. It has its headquarters in the English county of Suffolk; but although it has long been held in high esteem there, it has never obtained an extensive footing beyond the south-eastern counties of England.

Historical.—As to the origin of the Suffolk Punch, various accounts have been given. Low says: "The colour distinctive of this variety connects it with the race widely diffused throughout the north of Europe and Asia, from the Scandinavian Alps to the plains of Tartary, in which the dun colour prevails. It is believed to have been

carried to the eastern counties of England from Normandy, which yet possesses many fine horses of this variety, introduced, it may be believed, by the Scandinavian invaders."[1]

Arthur Young was a native of Suffolk, and in his report on the Agriculture of this county, compiled about the end of the eighteenth century, he speaks of "the old breed" of horses as if it had been specially associated with the district long prior to that date. Writing in 1878, Mr Herman Biddell says: "Two hundred years ago there were draught-horses peculiar to the county, and of standing enough as a distinct breed to maintain their prevailing characteristics through generations of descendants, long after the original type had been considerably modified by repeated selection, and the introduction of incidental crosses. How long prior to Young's time the breed had existed we have no evidence to show."[2]

Continuing, Mr Biddell says: "It clearly appears that there is scarcely a Suffolk stallion in the county, of any note whatever, whose pedigree is not clearly to be traced in a direct male line for seventy years. The records in the possession of the association, which relate to a period between 1790 and 1810, throw some light on the matter, and point to the introduction of materials not ill calculated to bring about the transformation that has taken place. Infusion of the Thoroughbred, Flemish, and heavier blood of native horses, has tended to exert upon the 'old breed' the influence such elements would be likely to produce; but as far as a careful search through the lineage of the horses now extant in the county will show, not one seems to have inherited the alloy in the male line, all of which terminate in an ancestry in all probability tracing back to the old breed mentioned by Arthur Young."

Since then opinion has been modified. In a lecture before the Framlingham Farmers' Club in 1907, Mr Herman Biddell remarked—

"I have seen over and over again the statement made that the Suffolk horse was the result of a cross from the Continent. It is said they are descendants of some Flemish ancestry. I have searched every available source from which this statement was likely to have emanated. I have been unable to find the slightest foundation for this mythological origin of the Suffolk sire. . . . There was a strain of Suffolks fifty years ago which came from a mare imported into the country from abroad. But the horse that had this strain in his pedigree could only have had an eighth of his parentage of this doubtful origin, but this is the only instance of authentic introduction of foreign blood that I could discover."

The most salutary influence on the modern Suffolk was exercised by a trotting stamp of horse from Lincolnshire, brought down about the middle of the eighteenth century by a Mr Blake of St Margaret's, Ipswich. This blending of "Blake's strain" with the old county type of horse produced, in the opinion of qualified authorities, animals as handsome, or nearly so, as horses of our own day.

Characteristics.

Colour.—The colour is the most distinctive feature in the Suffolk breed. It is a chestnut of varying hue, with lighter coloured mane and tail. The bright chestnuts are the favoured colour. It is a peculiar fact that no breed reproduces truer to colour than the Suffolk. Silver-haired horses are met with, but so long as they are not roans they are not objected to. The mealy colour is one of the worst.

Form.—Arthur Young apparently had not a very high opinion of the breed. He cuts it off with this sarcastic touch: "Sorrel colour; very low in the fore end; a large ill-shaped head, with slouching, heavy ears; a great carcass, and short legs: an uglier horse could hardly be viewed." Now, however, the breed is gainly, although it is still a thick, chubby, or punchy animal, with a body disproportionately large for the length of its limbs. Its legs are stout, full of substance, and now flatter in the bone than was at one time the case. The charge that the Suffolk is a round-boned horse need not seriously be considered, for there is a tendency to run

[1] Low's *Domesticated Animals of the British Islands*, 1842, 619.

[2] *Live Stock Journal Alk.*, 1878.

to the extreme of quality with bone of "razor"-like character.

A great improvement is discernible at the ground. Up till near the end of the last century bad feet were comparatively common, and while it cannot be urged that the attainment of perfection has yet been reached, still the casual observer who remembers the earlier appearance of the breed must admit that there are plenty of open coronets and good thick feet to be found in modern Suffolk studs. It is not the case that the Punch is unpopular for the London dray trade because of bad feet. The fact of the matter is, that he is hardly big or weighty enough to compete for this traffic with the strong and massive Shire, which all but monopolises the market. But for heavy van work there is no better horse than the Suffolk.

Measurements.—The limbs of the Suffolk horse have a naked appearance, for they carry little long hair. A good measurement of bone below the knee for a stallion is 10½ in. It is mentioned that Mr Smith's famous sire "Wedgewood" girthed 7 ft. 11 in., and measured as much as 10¾ in. below the knee, which must be considered good, as there was no hair to include. In point of height, 16.2 hands is about the limit. Mr Biddell goes as far as to say that "unless extremely well put together, anything over 16.1 hands should be viewed with suspicion."

Action and Handiness.—The action of the Suffolk is not the least potent recommendation of the breed. A fine agile walker, he uses his joints well, snapping his knees sharply. For farm work his speedy and willing service is much appreciated. When in the early days of Clydesdale "horse-breeding by the book," when that breed was making new supporters in the north of Scotland, not a little of the opposition it encountered in Aberdeenshire was from the Suffolk mares. At the end of a drill they are speedy and handy to turn, and give equal satisfaction between the shafts.

This fine spirit with which the Suffolk horse goes to work is no doubt inherited. In the olden days it was the custom in Suffolk to enter horses in pulling matches. Prior to the institution of agricultural shows these pulling matches appeared to be of the nature of sporting institutions. Sir Thomas Cullum writes of them thus:—

"A trial is made with a waggon loaded with sand, the wheels sunk a little in the ground, with blocks of wood laid before them to increase the difficulty. The first efforts were made, as usual, with reins fastened to the collar, but the animals cannot when so confined put forth their full strength; . . . that they may not break their knees in the operation, the area on which they draw is strewn with soft sand."

It requires no stretch of the imagination to connect the willing service of the modern Suffolk with the exercise of his talents in this peculiar way. Although capable of growing to a ton weight, his powers of haulage are not entirely to be measured by the avoirdupois he can put into the collar. Activity and sustained muscular effort count for much.

Docility and Longevity.—Docility and longevity are two points which can be claimed for the breed. The value of the former need not be emphasised: it is apparent.

Many cases of wonderful longevity are on record. One of these is worthy of mention. At one of the earlier exhibitions of the Suffolk Agricultural Society there was a mare shown which had entered her thirty-seventh year. More remarkable still, she was suckling a foal.

The Suffolk Horse Society.

The Suffolk Horse Society was established in 1876, and had in 1908 239 members. The chief scheme of the Society for the advancement of the breed was that of assisting farmers to acquire mares, which, by partial payment and subsequently by realising the foals, became their virtual property in three years. This scheme was inaugurated in 1897, when the Society was empowered to purchase thirty nominations to approved sires. The owner from whom a nomination was bought was asked to restrict the service of mares to the number of eighty to the stallion in that year. Tenant-farmers whose holdings did not exceed 200 acres were to apply under the

scheme, in response to an advertisement, and if chosen they were required to sign an agreement to deliver the foal, unweaned and free of cost, on a sale day to be fixed, and to accept £15 from the Society as purchase price, the Society taking the risk of getting a higher or lower price. Thirty nominations were taken up, at a cost of £2 each, and fifteen foals followed in September 1899, which realised, after deducting the auctioneer's charges, £17 each. Each live foal cost the Society £3, 6s. 8d., so that there was a deficit of £1, 6s. 8d. on each of the fifteen foals.

The main difficulty was to find suitable mares, so the Society went one step further and bought mares for farmers, who, on getting possession, paid 25 per cent of the purchase money, the remainder being loaned at 4 per cent. If the mare proved barren for two years, or in case of accident, the Society had the right to dispose of the mare, dividing the proceeds with the tenant-farmer in proportion to his indebtedness. The price agreed on for the delivery of the foal was raised to £16, 10s.

Foreign Trade.—The foreign trade for the breed is considerable. On the Continent it is popular as a useful cross for producing a heavy class of artillery horse. Many go south of the Equator, but the demand is chiefly from Russia and other Continental countries. There is a possible field for the breed in the United States, where the draught-horse type most popular is very much like the Suffolk. With their indifferent roads, the heavy horse with hirsute heels does not seem to enjoy the same popularity as the clean-legged type in certain parts of America.

Leading Shows.—The chief shows at which the Suffolk is exhibited are Woodbridge, Suffolk, Essex, and Norfolk county meetings, and the Royal Agricultural Society's Show. Suffolks are also included in the Cart-horse Parade in London, and fine teams have been exhibited at the International Horse Show at Olympia.

MANAGEMENT.

The Suffolk stud does not differ in respect of management from studs of other heavy breeds. The same routine is followed, the same foaling dates arranged, the same feeding carried out.

Half the management of the stud lies in the right treatment and mating of the brood mare. The selection of a stallion, with the travelling facilities afforded by railway companies, is not limited to the horses in the immediate neighbourhood, for those farther afield may be visited.

Brood Mares.—During summer the brood mare has her foal at pasture and requires little attention. If she is a valuable brood mare only the lightest work sufficient to exercise her should be given. If she has no particular claims in the way of pedigree she may take her share in the work of the farm. Many are opposed to this working of mares suckling foals. It is not productive of evil effects, however, if the mare is not over-driven and heated and the foal not allowed to suckle when she is heated. Mares with very young foals should certainly not be worked.

The Foal.—Early weaning is favoured by many Suffolk breeders. On the farm it is an advantage if the foal can be weaned before the mare is wanted for the stress of harvest work. It is, however, a disadvantage from the point of view of producing a big growthy foal. Some mares have been allowed to suckle their foals from seven to eight months, but that is too heavy a drain upon the system to be advised. In show studs the temptation in this way is great when a foal is doing well, but for not more than six months, and preferably five months, should the mare be asked to rear her offspring.

Foaling time is a more or less anxious period. There are mares that like the human presence when foaling, while others dislike it greatly. The usual indications of approaching foaling are the uneasiness of the mare and the waxiness of the teats. For the first few days after the arrival of a foal it should be kept indoors. Then a sheltered paddock should be chosen, and in the course of a fortnight it may be turned out to grass in the ordinary way. Foaling in the open is not favoured, because it is more convenient to have the mare at hand. It would, however, avoid the danger of

contamination arising from the ordinary foaling-box, which manifests its evil effects in navel-ill and other troubles. If the foal is intended for show it should be kept in good condition by other means than mother's milk when the supply is scanty or the quality inferior. Cow's milk sweetened may be given, but only as a last resort. Concentrated food, like corn, should also be avoided as long as possible. The immediate benefit of extra food of this description may be apparent, but it only lays the foundation of future trouble.

Service.—Service is usually offered the mare the ninth or tenth day after foaling. If she fails to respond thus early the mare is tried again at three weeks, and thence every fortnight.

Food and Care in Winter.—Extra rations are allowed in winter, usually beginning about November. A little corn, and perhaps hay in rough weather, will carry the brood mare well through winter. Work in the chains is beneficial to the breeding mare. Carting may also be done up to within a short time of foaling, provided the mare is not backed. During the hard wintry weather a more varied ration is given than at ordinary times. There should be no frosty roots fed, and the allowance of turnips in any case ought to be small. Mares and draught-horses at work in winter will do well on a ration of crushed oats, bran, and a little bean-meal. A peck of maize (soaked) and an equal quantity of bran with pulped roots night and morning is another ration that is not uncommonly fed in Suffolk studs when the price of maize permits. Flaked maize is good for conditioning. The prejudice against maize for horses is well founded, unless the feeding is carried out with discretion. It will speedily find out the bad-legged horses when they are not sufficiently worked to throw off the surplus of the fat-producing material.

Grooming regularly, watering before meals, and periodical exercise in frosty weather, are important matters in successful stud management. It is a good plan to give draught-horses, young and old, the run of an open court for a time. They will get the exercise they want in this way.

Stallions.—The management of stallions has nowadays been reduced to the simplest of methods. In many studs they run out summer and winter, being taken up to the service-shed when wanted. Shelter-boxes in the paddocks are necessary as feeding-places, but they are not much used by horses for the purpose for which they are erected. It is a good plan to encourage "constitution" by allowing stallions to "rough it" during the winter, taking them under cover about three weeks prior to the show at which they are intended to be exhibited.

A portrait of a Suffolk mare is given in Plate 14, and a portrait of a Suffolk stallion in Plate 15.

THE CLEVELAND BAY.

Cleveland Bay horses have played an important part both in road and farm work. This is only what would be expected of a breed of horses of such size, action, power, and hardy constitution as the Cleveland Bays can claim. They are not now so widely used as in the pre-railway days, but they are still recognised as a very useful class of horses. At one time the variety bore the name of the Chapman horse, but it is now known by the name of the Yorkshire district with which it is mainly associated.

Origin.—The origin of the Cleveland Bay has exercised the ingenuity of several writers, who have puzzled themselves and their readers in vain efforts to account for the existence of the Cleveland Bay by promulgating elaborate theories of crossing between the Thoroughbred stallion and the cart-mare. It is unnecessary to enter into minute detail respecting these theories. The very conformation of the Cleveland Bay clearly points out that he cannot be descended from the cart-horse, the elegance of his quar-

ters especially showing that there can be no kinship between them; whilst the way in which, as a rule, the Cleveland Bay breeds to type, both in colour and conformation, precludes the possibility of his being the result of an elaborate system of crossing between the Thoroughbred and the cart-horse.

Mr W. Scarth Dixon, to whom we are indebted for notes on the breed, considers it very probable that the Cleveland Bay derives a certain proportion of his courage and endurance from a pretty large infusion of Eastern blood, which doubtless did take place in the earlier years of the Christian era.

It is also possible that the Cleveland Bay may have been crossed with the Scandinavian horse during the time that the Danes effected a settlement on the north-east coast of Yorkshire.

Characteristics.—The Cleveland Bay is a short-legged horse, standing from 16 hands to 16 hands 3 inches, seldom being found under the one, and only a few specimens being met with that exceed, or even attain to, the other. His head is rather plain, but is well set on, his neck is well placed, and his shoulders generally lie well back. His back is rather long, from the standpoint of a riding man, but it is strong and muscular; his quarters are long, level, and elegant; and his tail is well put on and well carried. He is remarkable for the quality of bone, which is as clean and flat as that of a race-horse, and his legs are almost clear of hair. His action is of a high standard of excellence, both in a walk and a trot; and although he has none of that knee action so much admired by the lover of the hackney, he moves his shoulders and hocks in rare style, and in a manner highly suggestive of getting over the ground. In modern times the complaint is sometimes heard that substance is being sacrificed to quality.

It is recorded of the famous stallion "Cleveland" that he measured 16 hands 1½ in. high, 9⅜ in. round the pastern, 10 in. round below the knee, 21 in. round the arm, 15⅝ in. round the knee, and 6 ft. 10 in. round the girth. Cleveland Bays are excellent workers on farms, especially on the lighter classes of land. They are hardy, active, and enduring.

Value for Crossing.—The value of the Cleveland Bay for crossing with other breeds is difficult to estimate, and to this very fact is to be attributed in no small measure that falling off in the numbers of the pure breed which a few years ago nearly led to its extinction. It was used in Scotland in the early part of the present century to improve the breed of agricultural horses in that country, and the results were, as a rule, satisfactory. Valuable riding and driving horses have been bred by crossing a short-legged Hackney sire with a Cleveland mare; and Cleveland mares crossed with a Thoroughbred horse have bred some of the best hunters that ever went out of Yorkshire.

Great care, however, is required in the selection of a stallion. The latter should be of an active, wiry character, with good shoulders, and a short strong back, and rather under than over 15 hands 3 inches. Especial care should be taken to select a horse with short legs, this being a far more important matter than size, for great size is to be avoided, even if the horse is ever so well put together. The second cross from a Cleveland mare makes the best hunter as a rule, retaining the size and substance of the Cleveland, and naturally possessing more quality and pace; but after the second cross the tendency is for the breed to lose size and degenerate. As an instance of the value of the Cleveland Bay as a foundation for breeding hunters may be cited the fact that some of the best hunters bred by Lord Middleton at Birdsall came third in direct descent from a Cleveland mare.

THE YORKSHIRE COACH-HORSE.

The Yorkshire coach-horse is an offshoot of the Cleveland Bay. It originated in the demand which sprang up in the earlier years of last century for big flash carriage-horses. The short-legged compact Cleveland mare was crossed with a big, lengthy, and flash Thoroughbred horse; the produce, whether horse or mare, was bred from, and eventually the Yorkshire coach-horse, or—as he was sometimes called, from the locality in which he was principally bred—the Howdenshire Cleve-

land, became recognised as a distinct breed.

Characteristics. — Possessing the length and fine level quarters of the Cleveland Bay, as well as others of his good properties, the Coach-horse also has much of the elegance of the Thoroughbred. He is apt, however, to grow leggy in the course of a few generations; what is gained in quality is lost in bone; and recourse has to be had to the old breed to restore that substance which is so essential in a good coach-horse.

From the Cleveland Bay and the Coach-horse are bred a large proportion of what are known in the trade as London carriage-horses. The larger and stronger animals are bred from mares of the former breed, and sired by either Thoroughbreds or Coach-horses; whilst the lighter and lesser horses are bred from mares of the latter breed, and sired either by Coach-horses of high quality or by Thoroughbred horses of a coaching type. Efforts made to unite the two strains were not attended with success.

MANAGEMENT.

The management of the Cleveland Bay and Yorkshire coach-horse does not differ very materially from that of other similar breeds. The method pursued by Mr Frank H. Stericker of Westgate House, Pickering, may be thus described: Brood mares four or five days after foaling are turned out into a paddock a few hours at midday, being put into well-ventilated boxes at night. The time out is increased as the foal gets older and stronger. The mare has a liberal diet of bran, oats, and chopped hay or straw, with the addition of a few carrots. The foal is haltered in its early youth, as it saves time and patience later on. The mare will "do" the foal better if later on she has the run of a bigger pasture or seeds and clover. A good supply of water is necessary, and so also is the provision of shelter. The foal is weaned usually about the first or second week in October.

Mr Stericker holds that brood mares are all the better of a little light work. When near foaling a feed of corn and bran with hay twice daily along with a few carrots or swedes is recommended, the idea being to get her into good though not high condition.

Foals benefit by running out during the day and having the shelter of a covered yard at night. With bran, oats, and a little boiled food, chopped hay, and carrots, the youngster will go on thriving, and gain bone and muscle. Do not house yearlings too much, but keep them on pasture as long as possible.

Regularity in feeding is one of the secrets of successful rearing. When bringing animals out for show, it is important to give no more food than will be eaten up. Exercise should be regular, and when breaking, a fortnight must be given with the bit in the mouth, leading about, and sending the animal round in a circle. The girth is then put on, and later the "dumb jockey." Driving about in strings should not be neglected, the mouthing being particularly attended to. Many accidents are caused and good horses spoiled by the groom being in too great a hurry in the early handling.

A typical Cleveland Bay mare, "Woodland Briar" 1318, is represented in Plate 18.

THE THOROUGHBRED HORSE.

Properly speaking, the Thoroughbred is not an agricultural horse. He does not come within the province of farm live stock, for the main object for which he is bred is speed. The only measure in which the "blood" horse trenches upon farm stock-raising is in the production of hunters, military horses, or, it may be, according to the cross, harness horses. It is therefore from that standpoint that he must needs be treated here.

It is unnecessary even to glance at the history of English horse-breeding as represented by the rise and development of the Thoroughbred. It will suffice here

to say that it is evident that the modern Thoroughbred is chiefly indebted to three great sires for his present position. These are: the Byerly Turk, the Darley Arabian, and the Godolphin Arab (which, by the way, many writers contend was a Barb).

It is natural that the customs of the race-course have placed their imprint upon the character of our Thoroughbred horses. Thus we find it freely contended that the Thoroughbred of to-day has not the stamina of his ancestors, which may or may not be true. But we do not now ride such punishing races as formerly, and doubtless, if the occasion demanded it, the necessary training would speedily vindicate the constitution of the modern Thoroughbred. It is also contended that breeders have sacrificed speed, which, if not quite accurate, we may assume to arise from the fact that the stop-watch is a more accurate method of checking a performance than was in existence in the earlier days of racing. One thing at least can be claimed for the modern Thoroughbred in which he is superior to his ancestors—he is a bigger horse. His descent may be assumed to be largely but not entirely Eastern. The pedigrees of some of the more famous horses in the olden time lend colour to the belief strongly held by several writers that the stamina of the English native mares, highly spoken of, was in some degree responsible for the "blood" horse as we know him to-day.

Thoroughbreds for Hunter Breeding.

The breeding of the pure Thoroughbred is not pursued to any extent by the ordinary farming classes. It is a business or hobby by itself. The fact, however, is undisputed that the most valuable animal in the equine world is a good Thoroughbred stallion.

The farmer has his uses for "blood." He finds it of inestimable service in the production of hunters endowed with pluck and stamina. The Royal Commission on Horse Breeding annually presents 28 King's Premiums, of the value of £150 each, for Thoroughbred stallilons which are allotted districts to trave in, the classes in which they compete. In later years the selection of stallions has been partly influenced by their period in training and their racing performances. These King's Premiums used to be offered as the King's Plates for racing, but for many years have been diverted to the much more useful purpose of assisting to stock the country with horses of a military type.

In the production of the hunter the Thoroughbred plays a prominent part. For harness purposes, too, an oblique dash of blood has been found to give character, colour, and courage to the stamp of animal produced; but it is obvious that a first cross is more likely to be productive of a saddle than a harness animal.

Forcing Young Stock.—It is the custom to force young stock, which is not likely to help the constitutional vigour of the breed.

Character.—Most people are familiar with the Thoroughbred type. Centuries of careful breeding have imparted an aristocratic air and carriage such as no other breed possesses. The fine sweeping arch of the neck, the thin nostrils, the prominent eye and short head, are familiar features. The shoulders slope, and are thin at the withers, which rise high. The deep rather than rounded rib, powerful loin, and graceful sweep of the limbs at the trot, no less than the perfect motion of every joint at the canter, are as well known to all admirers of equine style and symmetry as they are to those most deeply versed in the points and lore of the breed.

Plate 16 represents the Thoroughbred stallion "Diamond Jubilee."

THE HUNTER.

Strictly speaking, the hunter is a type and not a breed. It may in the course of time attain to the latter status, but for the present it is bred in so many different ways that it cannot even be considered as the product of a first cross —the dam usually being a half-bred or nondescript. There is a great field, however, for the production of horses of the hunter type. That field may indeed be considered limitless, in view of the fact that the hunter misfits are frequently suited for military purposes.

Type.—The typical hunter is a class of horse by itself. Usually the classification provided at shows divides them into light weights, carrying up to 12 st.; middle weights, from 12 to 14 st.; and heavy weights, from 14 st. upwards. The Hunters' Improvement Society divides them into horses for weights not exceeding 13 st. 7 lb.; over 13 st. 7 lb. and under 15 st.; 15 st. and upwards.

The most valuable horse, as a rule, is a weight-carrier. Here the difference between a blood-like weight-carrier and a heavy-boned hunter without "blood" characteristics is apparent. The former is invariably the more courageous and the faster type of horse, and most favoured by the *cognoscenti*. The points of a hunter are good forehand, deep sloping shoulders, short back, muscular and flat limbs, a strong loin, and well-developed quarters.

Method of Breeding.—The Hunters' Improvement Society hopes ultimately by the registration of foundation stock to build up a breed of hunters in the same way as the Hackney and Cleveland Bay breeds have been built and maintained. There is no reason why in the course of time this scheme should not be successful; but ere the breeder will cross the Rubicon and burn his boats much prejudice must be conquered, and a plain, practical demonstration of the fundamental truths of the Society's scheme be afforded to all and sundry. The half-bred registered sire has still to win his spurs against the Thoroughbred, and in the opinion of those who have grown grey in the study of the many problems involved, that sire must be phenomenally successful to do so. Not the least of the difficulties to be encountered is to prevail upon breeders to keep on for breeding purposes entire animals whose appearance indicates that they might sell well as hunters.

Scarcity of Mares.—The chief difficulty at the present time is not altogether that of securing blood sires up to sufficient weight and with speed and a racing record behind them. The average man possessing a half-bred mare expects with a Thoroughbred union to have a full-fledged hunter type of offspring. He expects too much of the sire, in spite of the fact that the Thoroughbred is the most impressive of all equine breeds. The mares themselves must first be bred ere the breeding of hunters can become universally profitable.

All too frequently the mares used in the production of hunters are themselves the result of a happy-go-lucky cross, so that the breeding of hunters becomes under such circumstances more a game of chance than skill. Cart blood is often traceable, and not a few of the mares mated with the Thoroughbred sire are either of the light runner type or simply active cart mares. Under these conditions the breeder may by chance breed an animal of the hunter type, but he is just as likely to obtain a nondescript. The ideal mare to mate to a weighty blood sire should herself have blood characteristics. Perhaps the heavy-weight hunter is not always bred in this way, but it is the surest and the simplest way of preventing the sportive tendency of cross-breeding.

Irish Hunters.—Hunting horses bred and "made" in Ireland have earned a wide reputation alike for their build, quality, stamina, and manners. On the female side they were mainly descended from the old varieties of Irish draught-horses, but they are deeply saturated with the blood of the Thoroughbred, and are entirely deserving of their good name.

The Cleveland Bay mare, as already stated, is frequently used in the production of hunters, the blood stallion giving the results that are the most satisfactory.

MANAGEMENT OF HUNTERS.

The management of a hunter stud may be said to begin with the mare. Having found a sire that "nicks" well with the mares in the stud, it is provident management to stand by him.

The mare should not be turned on to poor pasture when carrying her foal, as the brood state entails a considerable physical strain. The difference between a high priced and a moderately priced hunter is often only the difference between a very light-weight and a weight-carrier; therefore treat the brood mare well. When the foal arrives it is not necessary to artificially feed the mare and her progeny if there is good grass available. A little corn will do the dam no harm if the foaling occurs early in the year. Towards weaning-time it sometimes happens that the mare's milk is not sufficient, and neither mother nor offspring is thriving. A bite of corn and a fresh pasture are good correctives. It is as well to teach the foal to eat a little corn before it leaves the mother, so that possible loss of condition due to the severance may be the more easily averted.

Winter Treatment.—In the winter time a very good ration is 5 lb. of crushed oats and 1½ lb. of white pea-meal, divided into two feeds, and fed morning and night. This, with sweet meadow-hay and a handful or two of bran, will bring the young hunter fresh through the winter. A field provided with a shelter is all that is necessary, thus giving the youngster constitution as well as stamina—which latter is the great thing aimed at in successful hunter-breeding. Select a growing rather than a fattening pasture—land rich in lime being preferred. If the animals have a good stretch of land in which they can exercise there will be little attention wanted.

"Making" Hunters.—The education of the hunter really begins about three years old, although the elementary duties of teaching the young horse to be readily handled and accustoming it to the use of the halter are earlier attended to. Mounting is most important in a saddle horse—equally as important as in a horse prepared for harness. This being accomplished, saddling should be taken in hand and gentle riding exercise given for about six weeks. They may then be left to run at pasture till the autumn, and again put through their exercises. It is not wise to jump them till later—say in spring, when the horse attains his fourth year. The bones are better to set first ere they are put to the strain which leaping entails. They can then be gently ridden to hounds, but on no account should they be tired out on the initial journeys.

The work begins in earnest in the following winter, and they are ready to market as five-year-olds. The aim of the breeder should be a heavy horse capable of carrying at least 14 stone.

A portrait of a famous hunter is given on Plate 17.

THE HACKNEY HORSE.

The Hackney horse as it exists to-day is a breed possessing distinctive type and distinctive uses. It was originally associated with the old Norfolk Trotter, and in past days made many notable performances against time. Farmers used to employ them as cobs and hacks, their constitutional vigour and muscular power enabling them on occasions to carry to market, not only the farmer himself, but also his spouse on a pillion behind. So far as the history of the breed is concerned, Mr H. F. Euren's admirable essay in the first volume of *The Hackney Stud-Book* still stands as the best epitome of what

is known of the Hackney in the early part of last century.

Historical.

The name Hackney, writes Mr Euren, came in with the Normans, but the old Danish name Nag held its own. Hackney was applicable only to a pacing or trotting horse, while nag was and is used as a name for any riding-horse.

Hackneys and Trotters are frequently mentioned in old farm accounts from the year 1331 to 1518 (Thorold Rogers's *History of Agriculture and Prices*). In 1340, by 14 Edward III., s. 1, c. 19, one of three Acts passed to regulate purveyance and to make illegal the practice of sending the "king's great horses" on to farmers' lands; but there was reserved to the king's Master of the Horse privilege of purveyance for "a Hakeney," which he might have: in the Paston Letters, under date 1470: in Acts of Henry VIII.—1535-36, 1540, 1542—the last named providing that cart-horses or sumpter-horses were not to be reckoned as trotting horses: by Blundeville, the Norfolk parson, who was the first English writer on horses (A.D. 1558): by Thomas de Grey, *The Phœnix of our Times* (A.D. 1624), who spoke of the trotting horse as the English breed of horse, the troop-horse of his day.

The Hackneys of the eighteenth and nineteenth centuries trace back, almost without exception, to one horse, named "Shales," foaled about the year 1755. His sire was "Blaze." The sire of "Blaze" was "Flying Childers," which horse was a mixture of Barb and Arab blood. The dam of "Blaze," known as "Confederate Filly," had Barb or Turk blood in equal proportions with English blood of unknown breeding. The dam of "Shales," as of "Hopeful," another son of "Blaze," was a trotting mare.

From 1750 to 1780 Barb blood was freely used in Norfolk on trotting mares. The horse "Shales" is said in an old advertisement to have been "the fastest horse of his day." Through his get, "Scot Shales" and "Driver," came all the famous "Shales" and "Fireaway" stock of the end of the eighteenth century. Many of the good ones were bred in the Long Sutton district. The "Driver" stock first won popularity in Yorkshire—the "Shales" stock in Norfolk; but there was a regular interchange of the two strains from the outset. Their descendants, Burgess's "Fireaway," Wroot's "Pretender," and his son, Ramsdale's "Performer," Bond's (two) "Norfolk Phenomenon," Chamberlain's "Marshland Shales," and the "Norfolk Cob" family, are a few of the horses existing between the years 1788 and 1850, whose names occur often in the full pedigree of the horses which have won the Society's champion honours.

Notwithstanding that examination of an extended pedigree shows that the modern Hackney is frequently an inbred horse, it is claimed for the breed that it retains its old-time characteristics—good action, high courage, and great powers of endurance. M. de Thannberg, who for nearly forty years was connected with the Government studs in France, declared in 1873 that the Norfolk Trotter had transmitted these very qualities to the French horses, and thus established what is now known as the French coach-horse. The old custom of trotting against time and in matches, which prevailed in England in the early years of this century, having been discontinued, the qualities which won for the Hackney its old reputation are not now so plainly in evidence; but those who have a knowledge of back-breeding have no difficulty in selecting horses which shall transmit the old-time powers to the progeny.

Practice of Breeding.—The practice of the breeders of the Hackney, as shown by records from 1780 to 1820, was that of using the Hackney stallion on half-bred mares, the produce of Thoroughbred stallions and trotting mares. This has continued to be an almost universal practice in Yorkshire. In Norfolk there have been experiments made of using Thoroughbred stallions on trotting mares, and the result has not been so satisfactory as is the breeding in Yorkshire, as regards form, endurance, or action. The most experienced breeders are agreed that the truest mode of breeding Hackney stallions, so as to get a certain result, is to put the necessary Thoroughbred blood into the breed through the mare, and, better still, through her dam. The examination of hundreds of pedigrees received from Yorkshire has shown

me that in a very small proportion of cases—certainly not more than two per cent—Yorkshire breeders have followed this plan of using Hackney stallions—putting Thoroughbred blood into the breed through the mares only.

Characteristics.

Type.—When we come to the consideration of the modern Hackney from the point of view of type, we are confronted not with one but with several. The truest Hackney character is expressed in the animal that does not exceed 15.2 hands. In passing, it may be mentioned that the Royal Agricultural Society used to stipulate that the maximum height of a Hackney admissible under their classification was 15.2 hands. Beyond that height it is rare, if not impossible, to find a Hackney with that sweetness of character so freely seen in animals of smaller stature. The true Hackney is a beautifully built horse. He stands very squarely on good feet. His limbs are hard and flinty. He should possess short cannon-bones, but frequently one sees them longer than is desirable. There should be as much substance as the limbs can conveniently carry without losing quality. The back should, in the stallion, be short, the rib round, and the loins beautifully filled, the quarters more rounded than in the blood horse, and the tail carried like a bedecked spike, almost on a level with the top. The shoulders should be well laid, thin at the top but not too sloping. The forehand should be long, and the crest pronounced in the stallion. The eye should be bright, and the head express intelligence where no vice can lurk. The carriage is everything in a ride and drive horse. There should be a perfect blend of style and form, no angles being perceptible. The "blood" type was at one time more prevalent than now. Many breeders would welcome more "blood," as they agree that a bigger type of Hackney of better colour and more style could then be bred.

Height. — Hackneys are bred to a greater height than formerly. It is quite common to meet with 15.3 hands and 16 hands mares and stallions, but, as before remarked, the smallest type is preserved by animals 15.2 hands and under.

Colour. — Colour is an important matter in a harness breed. If the hues are difficult to match it is only natural that the value of an animal is reduced. The most prevalent colour is chestnut, the shades varying from a light chestnut to a dark and liver colour. White markings are very prevalent, being handed down from stallions which have won important prizes. They are an undoubted defect from a harness point of view. The soundest colour is bay with dark points. Browns and blacks are also good. Roans and skewbalds are sometimes met with.

Action.—The commercial value of the Hackney is determined by one thing—action. With action the most indifferent horse will meet a ready market. Without it the most perfectly formed horse will be neglected. The Hackney clearly excels all other breeds in brilliant use of its limbs. High, free, and rhythmic movement is most of all encouraged. At one time it was more important to move high, after the style of the funeral horse, than to exhibit that liberty of shoulder nowadays demanded. The knee must be snapped to give style and sharpness to the movement, while the hocks should be closely carried, the more nearly parallel to the belly the better. A first-class Hackney showing his paces as nearly represents "the poetry of motion" as it is possible to conceive.

For Harness and Saddle.—The question might be asked, Is the Hackney a harness or saddle horse, or both? To some extent the types conflict, especially when extravagant action is demanded of a harness breed. It may be readily conceived that if the ordinary hack, which represents the acme of comfort in saddle, derives much of its popularity from its unattractive action, the free use of the shoulders, and the propulsive power of the hocks and loins brought into play in the type of movement demanded of the Hackney, would not conduce to a comfortable seat. This has led to the abolition of saddle classes for Hackneys at many shows, because animals were winning on action which was more suitable for leather than pigskin. The Hackney Horse Society provides no class for Hackneys in saddle, which implies in a negative way that the real vocation of the breed is to supply the harness horse

market. The old Yorkshire type of Hackney, now rapidly altering, was essentially bred to meet the two markets, but the tendency of the times is undoubtedly in the direction of breeding for the carriage and harness market generally.

Soundness.—The Hackney is one of the soundest, if not the soundest, breed of horses we possess. The charge is sometimes unjustly made that the modern type lacks stamina. This may be dismissed as an idle tale. Some show-yard animals may not be in a state of training for hard work, and to judge a breed by the artificially pampered specimens trained to show their paces for a brief period only is to do an injustice to the breed. No better proof of the soundness of the Hackney can be adduced than the following table, extracted from *The Hackney Stud-Book*, showing the number of rejections under the veterinary examination at the Hackney Show at Islington :—

Year.	Number Examined.	Passed.	Rejected.
1890	170	161	9
1891	116	112	4
1892	186	179	7
1893	249	241	8
1894	217	204	13
1895	223	219	4
1896	396	379	17
1897	438	415	23
1898	436	407	21
1899	437	379	30
1900	400	382	21
1901	406	418	16
1902	434	401	21
1903	422	392	24
1904	416	385	23
	4946	4674	241

Alterations in Form.—The appearance of the modern Hackney is vastly altered from what it used to be. It has lost some of that depth of frame and shoulder so common to the old Norfolk strains. Indeed, the blood cross appears to have been the dominating influence in moulding the modern Hackney. The head is clean cut but sweeter than the Thoroughbred. The stallion character is perhaps less marked than in the blood horse, but head and neck in the true Hackney should be beautifully proportioned. The muzzle is not so sharp, the appearance suggesting more docility than is associated with the Thoroughbred. The shoulders are sloping more so than in the riding-horse. In the older type there was a tendency to loaded shoulder points, but these have been fined down in the modern representatives of the breed.

MANAGEMENT OF HACKNEYS.

In the matter of managing a Hackney stud there is no specific axiom which can be laid down as the basis of success. Successful Hackney breeding is confined largely to the tenant-farmers, and save in cases where there are outstanding horses at the head of studs, it not infrequently happens that the breeding of this type of horse becomes an expensive hobby. The Hackney is kept very generally throughout the country. It is mostly in the hands of farmers, and except where studs of considerable size are maintained the ordinary farm buildings are made to suit the purposes of the breeder.

Buildings.—Those who equip their farms with expensive buildings are indulging their fancy. To the majority of Hackney breeders the inexpensive pile will answer the purpose quite well. The main buildings should be roomy, light, and sunny, free from draughts, and with adequate ventilation. At Mr A. W. Hickling's stud, at Adbolton, near Nottingham, the stud buildings are composed of wood, strong and serviceable, forming three sides of a large yard, facing south. They consist of a range of foaling-boxes, 20 ft. by 20 ft., 12 ft. high to the eaves, match-boarded under corrugated roof, well lighted, with brick on edge or rough finished concrete floors. Another series of boxes measures 15 ft. by 12 ft., and is similar in construction and ventilation to the foaling-boxes. There are ten roomy, airy yards, with open board roofs, which Mr Hickling says form capital half-way houses between field and stable for rough horses. The usual fodder and saddle rooms complete the buildings.

Close to the stud farm, in the fields around, are several large sheds with corrugated circular roofs and boarded ends, having long half-drain-pipe mangers down the centre, which, being boarded to the roof the entire length, afford protection from whichever quarter the wind blows.

For the purpose of training show

horses an enclosed level exercise-ground, oblong in shape, and equipped with a good sound track, is a great acquisition.

Many people erect riding-schools which are useful but costly. Young animals trained in the open do as well as, if not better than, those which receive their education indoors.

The Brood Mare.—The management of the brood mare is of first importance, particularly when the object in view is a full-sized Hackney. Mr A. W. Hickling gives his experience as follows:—

"Brood mares running out the year round produce better and stronger foals, and with less risk of accident, than those kept in yards or mares that have been going the round of the summer shows. When within a few days of foaling the mares are brought into their boxes and watched at night; then out again by day, often foaling in the field, with no bad results. Prompt attention to the newly born foal's navel is imperative. It should be tied and thoroughly disinfected, then for three days the mare should be fed sparingly on oat and bran mashes and chilled water, the foal haltered and handled. If all be satisfactory both mare and foal may go out every day except when wet.

"A frequent change of pasture during the summer keeps the foal in a forward growing condition, and until September no corn is needed. Then a mixture of crushed oats, bran, and chopped hay is given to mares and foals in tumbrils placed in the fields preparatory to weaning in early October."

Weaning.—Mr Hickling's method of weaning is to take mares straight from the foals to an outlying pasture beyond call, being fed during the winter months on pulped kohl-rabi and swedes, crushed oats, and chopped hay. The mare's udder should receive constant attention. The foals are better not confined in yards, but in the open, provided there is a good shed in the field, under which, however, they seldom go. Fed on similar lines to the mares, they usually grow into big and strong if not fat yearlings. Rock-salt is recommended within reach of all stock.

Young Stock.—With young stock Mr Hickling's plan is to arrange for all young mares and geldings not required for show to be "boarded" out with farmers having few horses of their own, and, where possible, run out not more than two together on dry sheltered land, and fed only on good hay or seeds. Even in winter they can remain out. By this method a change of pasture is provided for the mares, and it assists the vigorous development of the foals.

Stallions.—"Stallions," says Mr Hickling, "require when standing at home a good-sized airy box, the larger the better for their health's sake. Adjoining this should be a covering yard, enclosed and roofed. From experience, I am opposed to concentrated heating food for stallions, even with the prospect of a full season, finding on good oats, bran, hay, and green food a greater percentage of foals next year. Exercise must be regular and not less than two hours daily; in summer, early morning and late afternoon will be found the best times.

"I advocate plain open-air treatment, with plain living, for all breeding stock."

A Hackney stallion is represented in Plate 19.

ENGLISH AND IRISH PONIES.

Active public interest in pony breeding was greatly stimulated by the South African War, while the earlier establishment of the Polo Pony Society—afterwards styled the Polo and Riding Pony Society—has been of immeasurable service in stimulating and directing the improvement of the native races of ponies in this country. There are many kinds of ponies—ranging from the tiny Shetland to good-sized polo and harness ponies. Before briefly considering the distinctive races, some information may be given as to what a pony really is.

Pony Type.

The most natural answer to the question propounded above is that a

pony is a small-sized horse. This is true to some extent; but the bantam horse — say of the hackney type — can never, by any stretch of imagination, be called a pony. If an undergrown or dwarf hackney constitutes a pony, it makes an immediate departure from recognised pony type. Compare, for instance, a harness pony—say a hackney cross on a Welsh strain — with a pure-bred hackney that has remained of pony stature, and the reason for assuming that a pony is not determined by its inches immediately becomes apparent. Therefore let it be conceded that the pony is a separate and distinctive type of animal from the horse.

Lord Arthur Cecil, who has taken so much interest in the rescue of British and Irish native pony races, speaks with authority when he thus describes the true pony type:—

TRUE PONY TYPE.

Head.—Somewhat small, *ears* small, pointed and extremely sensitive.

Eye.—Bright, prominent, and with quite a distinctive look of intelligent determination. Very often of a light brown or hazel colour.

Mane.—Very often thick and coarse, and often lying on the near side.

Shoulders.—Thick and somewhat wanting at the withers, but generally fairly deep, which gives a look of being loaded at the point, but they are well laid. This is specially noticeable in ponies which have never been under cover, and have had to stand for hours, or even days, huddled up under a bush or rock for shelter with very little to eat.

Knees.—Generally big and strong, but apt to be rather close together from same cause as above. Cannon bone very short.

Feet.—Almost invariably excellent, but apt in action to be lady toed. This is almost an universal fault in mountain and moorland ponies, but of very great service in feeling their way over bad or soft ground. Nearly every deer-stalking pony goes so.

Croup.—Low and goose rumps. Faulty from same cause as shoulders. Disappears with first cross of good breeding.

Hocks.—Always of good shape and sound, but apt to be turned in at the point, especially if the pony is in weak condition.

Colour.—A rich brown is a colour which all the varieties seem to incline to, with a mealy or tan muzzle. Highlanders and Fell incline strongly to black, and Highlanders to dun and mouse colour, which I have reason to suppose may also be a very old Welsh colour too. A bright chestnut is rare, and generally means a cross of other blood somewhere.[1]

Points in Pony Breeding.

There is a great field for the extension of pony breeding in this country. Large tracts of moorland and forest—some of it Government land—are devoted to the raising of ponies which lead a wild untamed existence. The first point that the breeder has to consider is how to keep the stature within limits. It may be assumed that for harness purposes a pony should not exceed 14 hands, and for riding and polo 14.3 hands. The breeder is naturally confronted with the problem how to rear his ponies so that they shall not exceed these limits. In the polo pony the difficulty is more pronounced than in other breeds, for the pony to be valuable should reach not less than 14.1 hands and not more than 14.3 hands. Poor land is necessary. A bare existence is found to be the most practical method to adopt in early years and when fitting for show, a few weeks' preparation prior to the event, until the animal's stature is fixed by maturity.

HACKNEY AND HARNESS PONIES.

The hackney pony, which is the most brilliant pony for harness purposes, is either a variety of the true Hackney into which out-crosses have crept, and which have gradually worked into the Stud-Book, or merely a pocket edition of the larger breed. It is of two types—the essentially hackney type or little hackney and the pony type. It is safe to say that for pure adroit use of the limbs the hackney pony excels its big brother the Hackney. It is probably the most profitable form of pony breeding.

Not a little of the success of the hackney pony has been due to Mr Christopher Wilson of Rigmaden, Kirkby Lonsdale, whose daring feats in in-and-in-breeding are now a matter of history. The modern hackney pony owes much to Mr Wilson's brilliant sire "Sir George,"

[1] *Farmer and Stock-Breeder Year Book*, 1906.

which on eight occasions won first prize at the Royal English Show. He possessed a strong dash of Norfolk blood.

It is undoubtedly the case that the hackney pony has inherited his chief merits from the hackney, which has exercised a masterful influence in such crosses as have been made. Thus we find that Mr Christopher Wilson's success was founded partly on his selection of Cumberland mares and crossing them with the hackney pony stallion. His experiments in in-breeding were too bold to be universally adopted, but the breeder knowing the material with which he works, there is no room for doubt that the best means of fixing a type is by judicious close breeding. In Mr Wilson's stud the result of the first union with "Sir George" was again mated with him, this process being repeated successfully a third time. The most curious fact is that neither constitution nor substance were lost in this daring experiment in breeding, which seems to imply that the initial course must have been more or less violent, though apparently not sportive.

There is less to be said concerning the hackney pony than almost any other type, for it is so closely associated with the hackney in blood and, shall we say, in form, that an extended description would savour of repetition. One thing, however, may be remarked concerning the hackney pony, and that is, that it is usually of a sounder colour than the hackney. There are fewer mis-marked animals, more bays, browns, and blacks. This is probably due to the fact that the successful show ponies which have in later years been most fortunate at stud were themselves of sound colour.

The hackney pony stallion "Bantam King" is represented in Plate 20.

THE POLO PONY.

The progress of polo in England gave birth to the Polo and Riding Pony Society, which has done much to foster the systematic breeding of ponies suitable for the game. The polo pony is a product of no one recognised cross, but the aims of the Society if carried to fruition are likely to provide an accepted type to breed to, and to guide breeders in the selection of stallions and mares which are likely in the future to furnish the right class of animal.

So far breeders have been feeling their way in a somewhat perplexing manner. The claims of mountain and moorland ponies as the progenitors on one side,—chiefly Welsh,—and the Thoroughbred, Barb, and Arab stallions on the other, have been advocated with vigour, if not with warmth. From the chaos of conflicting opinions certain facts concerning the breeding of polo ponies emerge. In the first place, the limit height according to the Hurlingham standard is 14 hands 3 inches. Hurlingham and the Polo Pony Society now see eye to eye. The type of pony most in demand is the hunter type with pony character.

With these two salient facts before them, breeders are asked, so to speak, to produce the material which will enable the polo player to discard the imported horse and the pure Thoroughbred in favour of home industries.

From the breeders' point of view, it is unfortunate that the margin of height is liable to create so many misfits in what is, after all, the progeny of a cross. Again, unless the breeder is competent to mouth and train his own stock, he may produce the best-looking ponies in the world and be badly recompensed for the trouble. The value of a polo pony is dependent upon its stamina, appearance, speed, and training.

It has been estimated that the number of polo ponies in connection with Ranelagh, Hurlingham, and Roehampton is 3500. It is stated in the records of the Roehampton Club that in one year no fewer than 6000 ponies passed through its gates.

The best ponies are bred from mares which themselves have done real hard work. For reproductive purposes, probably, there is no better cross than the small Thoroughbred or the Welsh pony. There are acknowledged polo pony sires which have won prizes at shows in London, and their reputation is justified by the stock they produce. For the average breeder, however, the first direct cross is still the only means of production.

A portrait of the characteristic polo pony mare "Ruby" is given in Plate 20.

THE DARTMOOR PONY.

Dartmoor, with its rough range of 20,000 acres of moorland, has long nurtured a breed of pony which has distinctive features. Not a little portion of this land belongs to the Duchy of Cornwall, the rights of common being let out. Although at one time the regulation was promulgated that no sire over 12 hands high was allowed to run on the moor, that regulation did not long exist. The one temptation against which the breeders of the Dartmoor, in the eyes of the best informed judges, should fight is increase of stature.

Various efforts have been made to improve these ponies by the use of the small Thoroughbred and the Arab. No doubt numerous crosses, including the old Devonshire Pack Horse, have crept in, but there are still pure-bred animals,—at least in type they approximate to it,—which show that expressive countenance which usually stamps the true Dartmoor.

Early improvers of the breed included a well-known farmer named Eliot, Lord of the Manor of Brent, Mr John King, whose herd ran on Buckfastleigh moors, and Mr Hamblin of Buckfastleigh.

Of the capacity of the Dartmoor pony to carry weight there can be no doubt. Its conformation approximates to the hunter type. Not a few of them, however, exhibit indifferent heads and shoulders, no doubt due partly to the efforts of "improvers," by the introduction of unhappy alien crosses. First crosses on these ponies, as a rule, are not very successful.

Nature has made the Dartmoor pony strong in constitution, and like many of our hill races, lean fare and inclement weather have not formed them at the rumps and hocks as well as might be wished. The pony never stands with his head to a storm. The height of the Dartmoor pony should not be more than 13 hands.

A portrait of a Dartmoor pony is given in Plate 24.

THE EXMOOR PONY.

The Exmoor pony, which is the near neighbour to the Dartmoor, is equal to him in stature. History accords to this pony a lengthy tenure of that great stretch of moorland. Near the beginning of the nineteenth century Sir John Knight acquired some 20,000 acres of the moorland with the main object of raising ponies thereon. He subsequently extended his proprietorship by taking in part of the land owned by Sir Thomas Acland, and at the same time purchased the famous herd of ponies which Sir Thomas had reared. About this time various crosses were tried, including the Arab and the Thoroughbred, which had the effect of raising the stature. Sir Thomas Acland took a prominent part in the improvement of the Exmoor pony, his strains being highly valued by breeders generally.

The Exmoor is a very hardy, sure-footed pony, with a rare constitution. The head is cleaner cut than that of the average Dartmoor pony, the ears being sharp and intelligently carried. The shoulders are finer than in most pony breeds, the back short and powerful, and the legs and feet good. The typical Exmoor pony is very active, as might be expected of the denizen of a rough moorland tract.

Reference to this breed would be incomplete without mention of the fiction-famed Katerfelto, whose appearance amongst the native ponies is supposed to have exercised a wonderful influence on their character. This dun stallion, it is asseverated, was no creation of the imagination, his mysterious appearance being assumed to be due to a wreck on the adjacent coast, whence he escaped inland.

In Plate 24 a portrait is given of the famous Exmoor pony stallion "Twilight," the property of Mr H. Dyson, Priory Farm, Pamber, Basingstoke.

THE NEW FOREST PONY.

The New Forest pony is stated to have held the "field," by which we mean the Forest, since the times of King Canute. There are some 70,000 acres of Crown property in the Forest, so that the indigenous race of ponies has had every opportunity to lead a wild and roving existence. A society was formed

for the purpose of protecting and improving this race of ponies, but its work is not much known to the public.

The Arab stallion has undoubtedly exercised a considerable influence on these ponies, the late Prince Consort taking an interest in their welfare. Perhaps to the influence of Arab blood is due the large number of grey ponies to be found in this particular race.

The New Forest pony is in some ways not comparable with the other ponies of the south-west. In the New Forest there are many typical ponies, if we accept the head as exemplifying pony type, but the original character of the race has been to a great extent submerged in the multifarious crosses to which it was subjected. The main attempt on the part of improvers was to keep up the size, which has gradually been dwindling since the plantings and enclosings began in 1834.

A portrait of a New Forest pony is given in Plate 24.

THE FELL PONY.

The Westmoreland and Fell ponies have in all probability much in common, and a very useful class of ponies they are. This type of pony has been used to a considerable extent in the production of the well-known "Galloway," and a certain element has percolated through the famous stud of Mr Christopher Wilson, Rigmaden, Kirkby Lonsdale, into the harness pony.

The Fell or Dale pony is very hardy, and withal has an appearance of breeding. It is nothing if not full of stamina. It is a larger race than the southern moorland type, but has the same bright eye, alert head and ears. The winter coat is usually exceptionally heavy, for the snowstorms are severe. A degree of sure-footedness is acquired to which southern breeds, if not altogether alien, are at least not called upon so freely to exercise.

The trotter and the roadster blood have so altered the original Fell pony that the type has undergone an undesirable change on the mountains surrounding the Lake District. The aggressive sheep, too, has been responsible for much of the neglect surrounding the maintenance and improvement of the Fell pony.

Lord Arthur Cecil mentions as indicative of the stamina of this race, that one pony which he knew carried eighteen stone on parade with mounted infantry every day for a month, "sometimes doing her twenty miles a-day when she was only three weeks off grass, in the month of March, having been out of doors all winter without a bite except what she picked up."

The same authority continues: "They are the kind that carried Kinmont Willie and Jock Elliot in their Border frays, and are probably therefore identical, or at any rate freely crossed, with the old 'Galloway,' probably now quite extinct."

A portrait of a Fell pony is printed in Plate 23.

THE WELSH PONY.

The Welsh pony is probably the most serviceable type of hill pony that we possess. There is no cob to equal him either for rough saddle or harness work. In past times he has been bred without due regard to the future, and the variety of types that nowadays masquerade under the guise of a Welsh cob or pony is truly bewildering.

Much good was done by establishing a stud-book, which has led to greater care and skill being exercised in the improvement of the breed. The chief modern influence on the Welsh pony is the Hackney cross, which is largely permeating Wales.

The points of a Welsh mountain pony are thus officially set forth:—

General character. — Hardy, spirited, and pony-like.
Height.—Not exceeding 12 hands 2 in.
Colour.—Any.
Head.—Small, clean cut; well set on, wide between the eyes, and tapering to the muzzle.
Ears.—Well placed, small, and pointed.
Eyes.—Full, bright, and sensible.
Nostrils.—Prominent and open.
Throat and Jaws.—Finely cut.
Neck.—Fairly lengthy, and moderately lean, with a stronger crest in the case of a stallion.
Shoulders. — Long, and sloping well back; fine at the points, with a deep girth.

Back and Loins. — Muscular, strong, and short-coupled.

Hind Quarters.—Lengthy and fine; tail well set on, and carried gaily, undocked and long preferable, but the reverse not a disqualification.

Fore Legs.—Well placed, free at the elbow; long, strong fore-arm, well-developed knee, short, flat bone below knee, pasterns of proportionate slope and length; feet well-shaped, and hoof dense.

Hocks. — Wide, large, and clean, parallel with body, and well let down; shank flat and vertical.

Action.—Quiet, free and straight from the shoulder; knees and hocks well flexed, with straight and powerful leverage, well under the body.

The type of Welsh cob suitable for remount work is thus described:—

Head.—Small and flat, showing pony character, with fine silky hair under the jaws when rough.

Neck. — Well defined where it joins the shoulder, giving the cob a good "look-out."

Shoulders.—Well laid and strong.

Back and Loins.—Back not too long; loins muscular and strong; tail well set on and not goose-rumped.

Second Thigh.—Well developed, not too long from stifle to hock or from hock to the ground.

Fore Legs.—Should stand well outside the body and placed well forward; big knees, flat bone, moderately sloping pasterns, feet round, well-formed, not "boxed" or too big. When in the rough there should be a moderate quantity of fine silky "feather" on the back of the legs. Hard wear and tear fetlock joints are absolutely essential.

Action.—Free, true, and forcible, and they should bend their knees and hocks as much as is compatible with pace and staying powers.

A portrait of the famous Welsh pony stallion "Greylight" is given in Plate 21.

THE CONNEMARA PONY.

The Connemara pony is a thoroughly useful type of a small horse. For light farm work it is well suited; in most respects it is almost an ideal horse for the small holder.

A peculiar interest attaches to the history of the Connemara pony. Low, writing of it in 1842, says—

"The horses of Spain have been referred to as having contributed to form the mixed races of the British Islands; but it is not generally known that a race of horses of Spanish descent, nearly if not altogether pure, exists in this country in considerable numbers. They inhabit the Connemara district of the county of Galway. The tradition is that from the wreck of some ships of the Spanish Armada on the western coast of Ireland, in the year 1588, several horses and mares were saved, which continued to breed in the rugged and desolate country to which they were thus brought. But the aid of tradition is in no degree necessary to prove the origin of these horses, since all their characters are essentially Spanish. They are from 12 to 14 hands high, generally of the prevailing chestnut colour of the Andalusian horses, delicate in their limbs, and possessed of the form of head characteristic of the Spanish race. They are suffered to run wild and neglected in the country of mixed rock and bog which they inhabit, and where they are to be seen galloping in troops amongst the rugged rocks of limestone of which the country consists. When they are to be captured, which is usually when they are three or four years old, they are driven into the bogs and haltered. They are hardy, active, sure-footed in a remarkable degree, and retain the peculiar amble of the Spanish Jennet. Any selection may be made from the wild troops, after being hunted into the bogs; and individuals are obtained at a trifling expense.

"It must be regarded as remarkable that these horses should retain the characters of their race for so long a period in a country so different from that whence they are derived. They have merely become smaller than the original race, are somewhat rounder in the croup, and are covered in their natural state with shaggy hair, the necessary effect of a climate the most humid in Europe. From mere neglect of the selection of the parents in breeding, many of these little horses are extremely ugly, yet still conforming to the original type."[1]

To Low's interesting sketch of the

[1] Low's *Domesticated Animals of the British Islands*, 1842.

Connemara pony little need be added. The general features of the breed are still fairly well maintained, though the variety have lost some of their value through lack of care or method in breeding and rearing. In later years, mainly at the instigation of the Irish Department of Agriculture, interest in the breed has been revived to some extent, and there is reason to believe that Connemara ponies have a highly useful future before them.

Chiefly as a result of indiscriminate crossing, the draught-horses of Ireland have unfortunately lost all claim to recognition as a distinct breed, and practically, therefore, the only distinctive race of Irish horses are the ponies of Connemara. This consideration should in itself act as a strong stimulus to Irishmen in their revived efforts to improve these ponies and extend their use throughout the country.

By the kind permission of the Irish Department of Agriculture, a portrait of a typical Connemara pony is given in Plate 23.

MANAGEMENT OF PONIES.

The management of ponies naturally varies with the class of pony kept, the character of the farm, and the objects the breeder has in view.

Size. — Generally speaking, the first thing to be looked to is to treat the individual so that he or she will not exceed what is the recognised limit of size. Taking Hackney ponies as an example, it is a mistake to keep them on rich land. They are apt to overgrow, and no class of stock is harder to sell than an animal that is too big to be a pony and too small to be a horse. Hard fare up to a certain age—say, three or four years —may therefore be considered good management on the part of the pony-breeder.

There is a great temptation to run ponies thickly on the land to keep the height down, but more than one breeder has found to his cost that horse-sick land is a greater evil than over-sized ponies. Hay in winter is the usual feed.

Wintering Hill Ponies. — In the mountains and moorlands ponies cost next to nothing to keep, the chief expense being wintering. It is the custom in Wales to bring ponies from the hills in November and graze them in the lowlands until March. When snow is on the ground they usually get a little hay, but often they have to fend for themselves. After the bare living of the hills, the ponies usually return from the low winter quarters quite fat and sleek without having even a handful of hay. For show purposes special feeding is necessary, but the average hill pony mare is all the better if kept in natural condition.

Young Cobs.—In the rearing of cobs from 13 hands to 14.2 hands a little hay and corn may be fed during the winter. When it reaches three years old a cob can begin to earn its living, and it is a good thing to put it to light work in chains. This makes the cob more tractable and easy to handle.

Foals.—In the treatment of the foal the mother's milk comes first. The youngsters should be handled early, and at the period of breaking, which should not be delayed too long, it is advisable to undertake the work thoroughly. Many a good cob misses a market because this precaution has been neglected.

Ponies on Rough Pasture. — One aspect of the keeping of hill ponies should not be overlooked. They are invaluable for eating the rank grass in a pasture field which bullocks and other kinds of stock would altogether neglect. Moreover, they tear up the mossy herbage which makes it possible to manure effectively. One good authority declares that ponies and sheep, followed by a good strong chain-harrow with a little basic slag, will convert many acres of useless hill land into good mountain pasture.

Mr Tom Mitchell of Eccleshill relates, as indicative of the value of the pony on barren hill-land and the all but costless system of the keep, that he turned out twenty mares, chiefly Welsh, to forage for their living on hill-land in Ireland. He mated them with a pony stallion by "Sir Horace." He had 18 foals at the first foaling-time, and 14 on the second occasion. When sold as yearlings the produce averaged £20. This, he pleads, is more profitable than sheep would be on such ground.

The moral of it all is—keep ponies on bare living.

Training for Shows.—With regard to the Hackney pony and its training for show purposes, condition in the older ages is necessary, and it is well to allow as much corn as will give a little extra stamina to those of younger years. The chief thing sought after is to get style and action. The former is inherent; the latter is cultivated in two or three different ways. The clay-box makes the pony lift its limbs and develops muscle. Shoeing with heavy shoes has the same effect, the pony when exhibited being very lightly shod. Action developers are also used.

Limitation of Weight of Shoes.—The abuse to which the shoeing of show horses and ponies has given rise has compelled the Hackney Horse Society to take action. It has passed a resolution refusing to sanction a shoe heavier than 2 lb. on an animal exceeding 14 hands, and 1½ lb. on animals under 14 hands, as well as for yearling colts and fillies.

HIGHLAND PONIES.

The origin of the Highland pony is lost in the mists of antiquity. There is little doubt, however, that, like the Galloway pony in the ancient province of Galloway, and the Fell pony in the hilly parts of Cumberland and northern Yorkshire, the Highland pony was the original general purpose horse of the Highlands and Islands of Scotland. The three types partook to a large extent of the same characteristics. They were all equally strong and sturdy in the make, equally sure on the foot, and equally docile. These characteristics would be bred into them through a long process of selection, for in the days before the country was opened up by roads, the ponies, apart from walking, would be the only means of locomotion. The other qualities of hardiness and endurance, for which all three classes of ponies were equally distinguished, would be developed in the same way from the circumstances of their existence and the nature of their environment.

The Galloway Ponies.

A good many years ago, as the result of crossing and the invasion of their country by other and heavier breeds, the Galloway ponies ceased practically to exist. At the present time scarcely a real Galloway pony is known to be left; indeed, their old ground now forms part of the headquarters of the Clydesdale draught-horse breed.

Resuscitation of Highland Ponies.

For a time it looked as if the Highland pony would also be allowed to pass out of existence. It had been greatly crossed and degenerated by other breeds, and no one seemed disposed to lift even a little finger to save it. But the outbreak of the South African War, and the demand for mounted infantry, caused a fresh view to be taken of the utility of these hardy medium-sized animals, and since then Highland pony breeding has become quite popular, and numerous men of public spirit have taken up the work of improvement on systematic lines.

A "Highland" Committee has been added to the Polo and Riding Pony Society, while classes for the variety have again been introduced into the annual shows of the Highland and Agricultural Society. Fortunately there is still a fair amount of the old original material left, so that the work of resuscitation may now be expected to proceed on well-ordered lines, to the benefit of all associated interests.

Points of Highland Ponies.

The points of a model Highland pony have not been officially defined, but details which will have to be kept steadily in view are the size, stamina, and strength of the animals. In the past, Highland ponies have not, as a rule, exceeded 14 hands in height. Considerable num-

bers, and these not the least useful, have been under that limit. The head in the better class of ponies is small and neat rather than large and coarse. The neck is deep and strong without being abnormal, and it should run gracefully into the shoulders, the ridge in the case of the stallion being slightly arched.

In ponies of the old and unimproved breeds the shoulders have always been a weak part. They are inclined to be too heavy and upright for the tastes of the modern hunting- or saddle-horse enthusiast. This heaviness and uprightness of shoulder rather detracts from the appearance of the animals when walking or trotting, and does not permit of the fore-legs being thrown out, as is done in the case of breeds fitted with more oblique shoulders. But, of course, pace and action were only secondary considerations with the old Highland pony breeders. Much more important matters in their ponies were surety of foot and the provision of a reliable seat for their owners when they set out to make a journey. All the same, some little modification in this respect will probably have to be effected to bring many of the ponies into line with modern ideas and requirements. Whether this can be done by selection within the breed itself, or by the introduction of fresh blood as from the Arab or other source, is a matter that time only can prove. But whatever is done, care will have to be taken that the useful and rather special points of the ponies are not sacrificed to a showy daintiness which can quite well be obtained in other existing breeds.

The back of the best ponies should be short and muscular and the ribs well arched. The quarters should be deep and muscular and carried well down to the hocks, which should be slightly bent as in a Clydesdale horse. The legs should be hard and clean, and well covered, in winter at least, with a warm coat of hair. The pasterns should be of fair length, and the feet fairly wide and deep. Narrow feet are as objectionable in a pony as they would be in a horse of large size: such feet are apt to develop side-bones and other forms of disease.

As to colours, there is little doubt that the majority of the ponies in the early days of recorded history were greys, blacks, chestnuts, and duns, the duns having nearly always an eel-stripe along the back and down the quarters to the tail. Indeed there are those who maintain that the dun is the oldest colour of the four — the greys and blacks being of later date, and probably introduced through alien blood in the days when cross-Channel traffic with the Continent in horses was active. But however that may be, there is no hard and fast sticking to colours nowadays, although the majority of the ponies still to be seen in Highland markets and fairs are of one or other of the already mentioned colours. Should Highland ponies ever be required largely for mounted infantry work—as they will very probably be—a further modification in colour is by no means unlikely to come about.

Highland ponies have the reputation of living to great ages, and remain comparatively active and useful up to the last.

Early Studs.

Although the early origin of the breed is to all intents and purposes unknown, the history of several of the existing or bygone studs can be traced back for a great many years. Thus, as shown by Mr Thos. Dykes, in an article which he contributed to the *Transactions of the Highland and Agricultural Society* for 1905, the district of Glenorchy—or, as it was formerly spelt, Glenorquhey,—in Perthshire, was a great centre of Highland pony-breeding as early as 1600. In 1609 Lord David Murray, then Private Secretary to James I. of England and VI. of Scotland, writing from Whitehall, London, to the Laird of Glenorquhey (Glenorchy), says: "The Prince received a pair of eagles very thankfullie, and we hade good sport with theme, and according to his promiss he hath sent you a horse to be a stallion, one of the best in his stable for that purpose, and commendis him kyndlie to you and says that seven yeers hence when he comes to Scotland that he hopes to gett some of his breed."

The Royal Mews at that time are known to have contained many varieties of horses, Barb, Arab, Turk, &c.,

all of which were considered to be superior to our own horses as regards pace, style, and symmetry. It would, no doubt, have been a horse of one or other of these breeds that was sent north, and so kindly commended to the recipient.

Even earlier than this, however, mention is made of the ponies of this district. Writing of the great snow-storm of 1554, the chronicler of Finlarig says: "There was no thaw till 17th January. It was the greatest snow-storm that was seen in memory of man living. Many wyld horses and mares, kye, sheep, and goats perished and died for want of food in the mountains and other parts." These "wyld horses," as Mr Dykes says, were, no doubt, the ponies indigenous to the district.

That the Glenorchy stud at this time had a considerable reputation even outside of the district is proved by the records of Mr Cosmo Innes, who, writing of the Thanes of Cawdor, in Nairnshire, in his interesting work, *Scotland during the Middle Ages*, says: "Somewhat more care is shown of the breed of horses. Long before this time the lairds of Glenorchy had introduced English and foreign horses for their great stud in Perthshire, and the example was followed at Cawdor."

As early as 1638, Duncan Campbell, writing from Islay to his brother Colin of Galcantray, says: "I wishe if you may Cromarties old Spanish horse, provyding he be of a reasonable prys." In these days the ponies seem to have been kept on the hills in droves like sheep. The following entry, applying to fully a century later, appears in *The Black Book of Taymount*:—

"John, Earl of Breadalbane, lets to John M'Nab for five years the grazing hills of Bentechie and Elraig, with the full accustomed places where his Lordship and his predecessors' horses were wont to pasture in Glenorchy, delivering to him thirty stud mares either with foal or having foals at their feet, the one-half worth 30 merks apiece, as also 100 merks Scots to buy a sufficient stallion not exceeding five years of age, to be kept with mares on the said grass; and the said John M'Nab is to keep the mares and stallion on his own peril, and to be answerable for them in all cases, excepting only the case of daylight depredations and public harrying in a hostile manner, and to keep the stallion from labour. To pay the Earl the sum of ten pounds Scots for each of the lands yearly in name of tack duty, and at the expiry of his tack to re-deliver to the Earl the same number of mares and foals and a stallion of equal value with these he received, or to pay the foresaid prices for the mares and the stallions which are awanting. And in like manner ten pounds for every foal which shall be short of the number of thirty as above mentioned, delivering also the Earl's burning-iron, which he received for marking the horses.—FINLARIG, *11th June* 1702."

The Atholl Ponies.

Another very old stud appears to have been that at Atholl owned by the Dukes of Atholl. This stud fortunately is still, in part at any rate, in existence, and representatives of it have been seen of late years at the annual shows of the Highland and Agricultural Society. In 1904, at the Perth show of that Society, one of the Atholl ponies, "Bonnie Laddie," a three-year-old dun-coloured colt, carried off the president's medal as the best Highland pony. This pony (which is represented in Plate 22) was got by "Herd Laddie," also a very successful prize-winner. "Herd Laddie" in turn was got by "Highland Laddie," while his dam was "Jeannie," by "Campbell Lofty." "Bonnie Laddie" was an exceedingly purpose-like pony. He stood fully 14 hands high, had deep, well-filled thighs and quarters, a short, nicely coupled back, and a handsomely set on head and neck. His legs were very clean and strong, with just that little tuft of hair at the back of the fetlock joint so characteristic of the old equine breeds. He looked like a pony that could travel a long way and do a big day's work without much trouble. Unlike many Highland ponies, "Bonnie Laddie" had comparatively good sloping shoulders.

Although there are records of mares which existed before that time, the first recorded stallion of the Atholl stud was "Glentilt," a grey-coloured pony which

was foaled in 1862. This pony was bought from Mr Donald Cameron, Glengarry, Inverness, for £13, 10s., and sold to the Earl of Southesk for £60. According to a statement supplied by the Marquis of Tullibardine to Mr Dykes, he was the sire of several of the best hill ponies at Atholl, notably "Lady Jean" in 1867, afterwards used as a brood mare. This mare's dam was "Polly," a "garron" mare bought from Mr Halford, the tenant of Foss, who bought her in a Muir of Ord market.

In reference to the term "garron," it is well to remember that although in recent years it has been used as descriptive of the heavy mainland type of ponies, its real meaning is gelding, and in the early premium lists of the Highland and Agricultural Society it was so applied, there being separate classes for stallions and mares as well as for "garrons."

At Atholl the ponies are principally used for hill purposes in the shooting season. They travel long distances over the roughest ground, and are invaluable either for saddle or game-carrying purposes. A number of the ponies also formed mounts for the Atholl detachment of the Scottish Horse which did duty in Edinburgh on the occasion of the visit of his Majesty the King in 1903, and they created a very favourable impression amongst those who saw and recognised them, their sturdy make and hardy-like appearance being novel features in a great military display.

Inverness-shire Ponies.

A number of first-class studs are known to have been owned in different parts of the mainland of the county of Inverness. At least the remnants of a few of these still exist.

One of the best of the old Inverness-shire studs was that at Corriechuille, in Lochaber, which flourished some time prior to 1833. It was from this stud that the Gaick strains of blood so extensively used by Lord Arthur Cecil and Professor Cossar Ewart originally came. The Corriechuille ponies were of all colours — bays, browns, duns, yellow-creams, and piebalds. Little is known of their early history, but judging from the fact that some of them were taken to Gaick, and that they have been maintained practically pure there ever since, they must have been of a good class.

One of the best mares in the Gaick collection was "Gaick Calliag," a black by "Glentilt," which latter was bred in the near neighbourhood, and afterwards became principal stud-horse at Atholl. "Calliag" was purchased by Lord Arthur Cecil when sixteen years of age, and carrying her ninth foal, for £64, and afterwards passed into the New Forest, in Hampshire. At the same time her son was sold for £75 to Mr Forsyth of Quinish for the Congested Districts Board, and was forwarded to Professor Cossar Ewart, who used him, under the name of "Atholl," in some of his experiments at Penicuik. Several descendants of "Calliag" are still at Gaick, and the outstanding feature of the stud is its great hardiness. "Calliag" herself until she went south was never under a roof, this, too, notwithstanding the severe winters which were frequently experienced in Lochaber. At Gaick, as at Atholl, the ponies are mainly used for hill-carrying purposes, although they also do any carting that is required, being hand-fed only when at the latter class of work.

To some extent allied to the Gaick ponies were the Guisachan ponies owned by Lord Tweedmouth. This stud was descended from old Highland blood, but in late years the ponies had been crossed with outside blood with the view of getting more quality and style. The outside ponies used were "Seaham," by "Lord Derby II.," and "Guisachan Miracle," by the famous "Little Wonder II." Both were of Hackney pony blood to some extent, but that the cross was successful in producing at least a saleable pony was proved by the fact that at a draft sale in 1903 a pair sold at 130 guineas, a single pony at 68 guineas, and others as high as 50 guineas.

Ross-shire Ponies.

In regard to Lord Middleton's stud at Applecross, the following note from Lord Middleton, in the article in the *Transactions of the Highland and Agricultural Society* already referred to, may be quoted :—

"The present Applecross stud of ponies

was formed about the year 1878, though previous to that time my father, the eighth Lord Middleton, kept and bred ponies at Applecross. About that time he came into the possession of a grey mare, 'Kitty,' which he bought with the property from the Duke of Leeds in 1861. This mare had been bred by the M'Kenzies of Applecross, who had ponies at the time on the place, which was brought from Skye.

"The mare 'Kitty' was a good type of the Highland pony. In 1878 I bought a bay mare in foal from Mr Macrae of Glenbaragait in Skye. He (Macrae of Glenvarait) was of the same family as the Macraes of Camsunary, near Coruisk, in the Isle of Skye. This mare was a beautiful type of the Highland pony, small, strong, full of mettle. At that time she was in foal to a pony which took first prize at the Highland and Agricultural Society's Show. She dropped a bay filly, and both go respectively now by the names of the Old Skye mare and the Young Skye mare. From these two mares many of my ponies have been bred.

"In 1882 I bought a beautiful grey mare, 'Molly' (foaled 1872 or 1873), at the sale of Lord Dacre's ponies at Garve, Lord Dacre having then given up his forest. She was his favourite hill pony. I bought another, which did not breed. This mare 'Molly' was larger than the two Skye mares, about 14 hands, and strong. She had a family of three colts and two fillies to 'Glen.' 'Glen's' sire used to travel in Skye, and was a chestnut with a white mane. The eldest colt, foaled in 1884, was a chestnut with silver mane and tail. I have ridden him for the last fifteen years, and have always taken him with me to Scotland. He is a wonderful pony, very strong, up to 16 stone, can walk five miles an hour, is exceedingly wise and clever, and never makes a mistake. A sister (grey) was a carriage pony, and is breeding now. Another sister travels at Birdsall with the stallions. A brother goes in harness. The other colt I sold.

"In regard to types and colours, all my ponies are thick-set, strong, short-legged, and bred especially for carrying weights (deer) and for riding on the hill. Their colours are black, chestnut, grey, and bay. The chestnut probably comes in from 'Glen,' as I hold that chestnut and black are akin.

"In the spring they plough, cart, and execute the general work of the foresters' crofts. In the autumn they of course do the work required of them in the forests. Some I use as carriage ponies, some also I use at Birdsall for going messages—post-office communication and the like—or travelling as groom's mounts with the Shire or Thoroughbred stallions. All are brought to Birdsall to be broken. They usually arrive in a truck with the Highland cattle. They are then broken at the Hunter Stud Farm, and used for the different classes of work alluded to in order to make them quiet and tractable. Those required at Applecross are returned for work there.

"Some I have successfully bred from here (Birdsall) to the Arab stallion—beautiful hardy ponies, fit for polo or hacks, and I should think just the sort for mounted infantry. I have all through tried to keep up the Highland pony hardihood. Here and at Applecross they only get hay or silage during the snow-times. Of course during the stalking season they get a feed of corn daily. Except those used for carriage purposes, they are never under cover, and the latter are only kept up during the period they are used for carriage work, being turned out for the winter."

Fell and Arab Crosses.

The first recorded sire used at Applecross was "Glen," a black or brown, bred by Mr M'Leod, Coulmore, who was a noted Skye breeder for several years. Afterwards "Fitz George," a son of Mr C. W. Wilson's famous show and breeding pony "Sir George," was secured. The dam of "Fitz George" was a well-known Cumberland Fell pony. "Fitz George" himself was a 14-hands grey, very stout in the make, and with good action.

The stock of "Fitz George," from the Highland mares, showed great improvement in appearance and quality, and it was no doubt some of these that did so well at Birdsall, Lord Middleton's Yorkshire seat. But whether this cross or others available would be best for breeding military ponies is a matter

that experience in the work alone could settle. The Arab crosses undoubtedly have sweeter heads, but they are apt to lose bone and constitution, and it may be hardiness as well.

Island Ponies.

The ponies of the Islands are legion. There are the ponies of the Inner and Outer Hebrides, the Barra ponies, the Benbecula ponies, the Mull ponies, the Rum ponies, and the Skye ponies, differing all more or less in points of detail. At one time there was a widely prevalent tradition that the general excellence of the Island ponies, and, indeed, of many of the mainland ponies as well, was entirely attributable to the comparatively latter-day misfortunes of the Spanish Armada. While that particular theory is nowadays greatly discounted, there seems to be little doubt that Spanish blood, which of course was Asiatic blood in some form or other, found its way on to these Island shores. But the probability is that the greater part of the improvement was effected earlier, and in the ways otherwise mentioned.

Mull Ponies.

None of the Island ponies enjoyed perhaps a greater reputation in the old days than the Mull ponies. They were keen rivals even to the Galloway pony in its best days. No doubt the accessibility of the Island, and the fact that large droves were taken annually to the Falkirk and other trysts, had something to do with the preference, but all the same they were very useful general purpose small horses. They rarely exceeded 14 hands in height, but were so thick-set and strongly built that they could do as much general work as horses considerably larger, while they could exist on very moderate fare.

An excellent type of the modern Mull pony was the stallion "Islesman" (253 Polo Pony Stud Book), the property of Mr J. H. Munro Mackenzie of Calgary, Mull. With the view of improving the backs and shoulders of the Highland ponies Mr Mackenzie crossed the mares with "Syrian," an Arab hack brought from Algiers. The progeny is being put to "Islesman," and in this way Mr Mackenzie is hopeful that he may be able to effect some improvement in the form of the animals without deteriorating them in other respects. The owner of the Calgary stud is a firm believer in the theory that it was from the Arab that the good points of the Mull pony, and, indeed, of most of the Highland ponies, originally came.

Skye Ponies.

Skye ponies also had a good reputation for a great many years. Indeed the M'Leods of Coulmore, the Macraes of Glenvarait, and one or two others, kept their strains pure for a very long time, and bred many animals which were taken on to the mainland for breeding purposes. But in later years, especially in the southern parts of Skye, there has been a demand for rather bigger equine stock, and many of the ponies have been crossed with horses intermixed with Clydesdale blood. The result has not been very satisfactory.

Uist Ponies.

The Uist ponies, being farther removed from the mainland, have not fallen under the same adverse influences, and here many fine representatives of the old breed are still to be found. It was from Uist that the late Mr D. Stewart, Drumchorry, Perthshire, got his noted prize-winning stallion. "Mosscrop," as well as the mare "Heather." Both were bred at Balranald, and both had the old Highland characteristics in a marked degree.

Most of the outer Hebridean ponies are believed to have been of old Norse stock. Even yet some of the Uist strains of ponies have white or silver manes, this being also a characteristic of the Faroe Island ponies.

Rum Ponies.

Lord Arthur Cecil, who has long been a champion of pony breeding, has through various channels made known much interesting information regarding numerous varieties of ponies. In the article in the *Transactions of the Highland and Agricultural Society* for 1905 before referred to, his Lordship tells of "nine very good black ponies coming to Hatfield, which were said to have been running quite wild in the Island of Rum." All of them

were too wild to be broken except two, which "we hunted and drove till they were twenty-eight or twenty-nine years old." In 1888 his lordship bought eight Rum ponies with which he continued the breed. It was for use in this stud that Lord Arthur purchased the famous stallion "Highland Laddie," which became the sire of the Duke of Atholl's "Herd Laddie," and which his lordship says was identical with the Rum ponies in appearance.

Recent Experiments with Highland Ponies.

Numerous experiments have in recent years been made by the Congested Districts Board in the use of sires of various breeds in crossing with Highland pony mares. Strains of the Thoroughbred, the Arab, the Hackney, the Connemara, the Fell, and other breeds have all been tried. The results have varied greatly, and opinions regarding them differ somewhat. The Arab cross has gained a good deal of favour, but amongst experienced breeders there is a growing belief that in the main the wisest course is to seek for improvement by the skilful mating of selected animals of the native types.

Professor Cossar Ewart's Experiments.

In connection with the work of the Congested Districts Board an interesting feature was formed by the pony-breeding experiments conducted by Professor Cossar Ewart of Edinburgh University. For these experiments animals of practically all the noted Highland and Island pony breeds, as well as of such kindred varieties as the Connemara, Iceland, and Norwegian ponies, were obtained, and amongst the out-bred sires used were a Thoroughbred and an Arab.

The Celtic Pony.

Professor Cossar Ewart has made a careful study of the native races of Highland and Island ponies, as well as of other varieties of horses, and has come to the conclusion that what he classifies as the Celtic pony (*Equus caballus celticus*) is one of the most specialised of all the members of the Equidæ family. The typical Celtic pony of the present day he regards not as a product of artificial selection, "but as an almost pure representative of a once widely distributed wild species." The considerations which led the Professor to this conclusion are stated fully in an interesting paper on the "Multiple Origin of Horses and Ponies" which he contributed to the *Transactions of the Highland and Agricultural Society of Scotland* in 1904.[1]

Management.

To a large extent Highland ponies forage for themselves. It is the usual custom to turn them on to the hills or rough pasture out-runs and let them gather their food. As a rule, it is only when they are being hard worked that the ponies get corn, and it is the exception to allow them even hay when idle. In many cases little or no house accommodation is provided for them. What is provided is usually only partially enclosed.

A Highland pony stallion is represented in Plate 22.

SHETLAND PONIES.

The Shetland pony is unique in at least one respect—it is, so far as known, the very smallest of the equine races of the world. In some of the islands off the Swedish coast and in Norway there are ponies that are not greatly dissimilar in appearance from Shetlanders, and at one time there was a belief that the "Shelties," as they are frequently called, were introduced into the Shetland Islands by the Norsemen between 1300 and 1400. But these Swedish and Norwegian ponies are larger, as a rule, than the Shetland ponies, and the generally accepted belief now is that the latter were originally of practically the same stock as were to be found in the northern districts of the mainland of Scotland in

[1] Vol. xvi., Fifth Ser.

very early times, and that they were "ferried" across to the islands at a date much anterior to the period mentioned.

The long-continued maintenance of the Shetland ponies at such a small size is regarded as being due to the hard conditions under which they have been reared and the struggle which successive generations, even yet, have to engage in to obtain a bare existence.

Purity of Shetland Ponies.

The Shetland pony is probably also unique in respect of purity of blood. While most other breeds, large and small, have been more or less the subject of experimental crossing, the Shetlander has probably in most parts remained uncontaminated for hundreds of years.

A Norwegian Cross not Successful.—In the eighteenth century, according to Goudie, who writes on the early history of the breed in the first volume of the *Shetland Stud-Book*, published in 1891, an attempt was made to increase the size of the breed by crossing with a Norwegian pony of the stamp probably already referred to. But it was never carried to any great length, for the reason that the progeny would not have stood the rigorous conditions under which the "Sheltie" had to exist. There are still a few of the crosses in the Dunrossness district, where the land is comparatively fertile, and where it is the custom to stable the horses, but they range in size from 12 to 13½ hands, and are not Shetlanders at all in the generally accepted sense of the term. Moreover, they cannot be registered in the Stud Book, which is confined to animals 10.2 hands or under.

A Mustang Stallion Tried.—The same writer (Goudie) mentions that about the middle of the last century, on the island of Fetlar—there are nearly one hundred islands, great or small, in the Shetland group—Sir Arthur Nicolson introduced a mustang stallion among the ponies there. A remarkably fine stock of ponies was, it is stated, the result; but again they got too large, their size ranging from 12 to 13½ hands. A number of them also inherited the excitable temper of their feral ancestors and were difficult to tame, although very useful in many cases where a little size over the ordinary Shetlander was desired. These ponies are still spoken of as Fetlar ponies, as distinct from Shetland ponies.

With these exceptions, the Shetland pony has remained undisturbed by attempts at crossing, and even in the cases where crossing was attempted it never made great headway or touched the real heart of the breed.

Early Description of Breed.

Although several of the early historical writers make reference to the small horses of Orkney and Shetland, the first really good description of the Shetland breed was given by Brand, who visited the islands in 1700. In his book, *A Brief Description of Orkney, Zetland, Pightland Firth, and Caithness*, published at Edinburgh in 1701, this author says:—

"They have [in Shetland] a sort of little horses, called shelties, than which no other are to be had, if not brought hither and from other places; they are of a less size than the Orkney Horses, for some will be but 9, others 10, Nives or Hand-breadths high, and they will be thought big Horses there if 11, and, although so small, yet are they full of vigour and life, and some, not so high as others, often prove to be the strongest. Yea, there are some whom an able man can lift up in his arms, yet will they carry him, and a woman behind him, 8 miles forward and as many back! Summer or Winter they never come into an House, but run upon the Mountains, in some places in flocks; and if at any time in Winter the storm be so great that they are straitned for food, they will come down from the Hills, when the Ebb is in the Sea, and eat the Sea-ware (as likewise do the sheep), which Winter storms and scarcity of fodder puts them out of ease, and bringeth them so very low that they recover not their strength till about St John's Mass-day, the 24th of June, when they are at their best. They will live to a Considerable Age, as 26, 28, or 30 years, and they will be good riding Horses in 24, especially they'le be the more vigorous, and live the longer, if they be 4 Years old before they be put to Work. Those of a black Colour are Judged to be the most durable, and the

pyeds often prove not so good; they have been more numerous than now they are; the best of them are to be had in *Sanston* and *Eston*, also they are good in *Waes* and *Yell*, those of the least size are in the Northern Isles of *Yell* and *Unst*.

"The Coldness of the Air, the Barrenness of the Mountains on which they feed, and their hard usage, may occasion them to keep so little, for if bigger Horses be brought into the Country, their kind within a little time will degenerate; and, indeed, in the present case we may see the Wisdome of Providence, for, their way being deep and Mossie in Many places, these lighter horses come through when the greater and heavier would sink down; and they leap over ditches very nimbly, yea, up and down rugged, Mossy braes or hillocks, with heavy riders upon them, which I could not look upon but with Admiration. Yea, I have seen them climb up braes upon their Knees, when otherwise they could not get the height overcome, so that our horses would be little, if at all, serviceable there."

The Modern Type.

With the exception that the height of the ponies is even less now than then, and that the colours are not so much mixed, thanks in large measure to careful breeding, Brand's 1700 description remains true down to the present day. The ponies are still exceedingly hardy, nimble on their legs, and docile and tractable. Pretty much the same aims in the matter of the form of the ponies are also pursued by breeders. It would still be quite true to say that "some not so high as others often prove to be the strongest." The object of the breeders for many years has been to get as much power as possible on the shortest legs possible. This, of course, can only be got by strengthening the bone of the leg and widening the bodies and ribs of the animals.

Some years ago, when there was a keen demand from America for children's ponies, an idea got abroad that the very wide ponies were not the best for this purpose, as it was said that they led to cases of rupture. A more slim and narrowly got-up pony was accordingly in fashion for a time, but the theory was never greatly credited on this side of the Atlantic, and now next to nothing is heard of it. At the present time the wide sturdy-made ponies are almost exclusively the class that are in demand. The wider the pony is, provided his legs be strong and he is not too far from the ground, the more valuable he is considered.

Ponies in the Mines.

The preference for this class of pony is no mere fancy. By far the largest market for Shetland ponies is found in the coal-fields of Northumberland, Durham, and the southern districts of Scotland. There they are used for underground haulage—principally running the little waggons of coal to the pit-shafts. In some cases the ponies have to pass through workings little higher than themselves, and in these the gradients are often fairly stiff. It can easily be realised, therefore, that a low-sized pony, and at the same time a powerful one, is a real necessity.

Shetland ponies were first introduced into the coal-pits of the north of England about 1850. In 1851, according to Mr Robert Brydon, Mr Hunting, of South Hetton, than whom there was no better authority on animals for work in mines, bought thirty Shetland male ponies—all three, four, and five years old—at £4, 10s. per head, delivered at the collieries. Since then the prices have increased to a great extent. Average yearlings when the Stud Book was published in 1891 were worth in the north of England £15 per head; two-year-olds fetched about £18, and older ponies considerably more. These prices continue to be well maintained. Indeed, very small ponies are dearer now probably than ever they were, this partly being due to fancy, but to some extent also to the fact that they are suitable for working in thin seams where large ponies cannot enter.

The Bressay Stud.

Being an extensive coal-mine owner in Durham, Lord Londonderry would no doubt have had his attention early directed to the question of a good supply of ponies of the proper stamp and height for use in pits. Early in the 'seventies

of last century his lordship acquired the grazings on the islands of Bressay and Noss, and at once began to found a stud from the best animals that were to be found in the islands. The most careful selection was pursued in breeding, with the result that the Bressay stud soon attained to a distinguished position. Indeed for many years it was the acknowledged fountain-head of the breed, and the annual sales which were held at Seaham Harbour attracted buyers from great distances. The stud was dispersed some years ago, but even to the present day the blood of Lord Londonderry's ponies dominates the showyards through their descendants in the hands of other breeders.

Pony Management on Crofts.—The great aim of those who were in charge at Bressay was to produce a low-set sturdy animal which would have great power on short legs. Accordingly the stud was managed on somewhat different lines from those that generally prevailed among the other breeders. The average crofter—the Shetland Islands are composed very largely of small holdings—simply turned his ponies into the "scatholds," or common grazings attached to the crofts, and left them to mate themselves with whatever stallions happened to be in the vicinity. The result of this, and the great privations which the animals suffered in winter, coupled with the fact that the foals were allowed to suckle the mares for a year or more, was that foals were only produced, as a rule, once in two years and often at longer intervals.

Management in the Bressay Stud.—In the Bressay stud a more scientific system of selection and mating was adopted. About the end of May in each year the mares were divided into lots of from a dozen to fifteen and put into separate enclosures along with a stallion specially suited to each lot. A very perceptible difference soon appeared in both the quality and numbers of the progeny, the mares managed under this system seldom missing a foal every year. The foals were weaned in November and put on good pasture which had been saved for the purpose. They were taught to eat hay as soon as the state of the weather rendered it necessary, and in this way they stood the winter better, and reached the spring much stronger, than foals that were allowed to suckle their dams all through the year. The mares also got a very desirable rest, and were in good condition again by the end of May.

Points of the Breed.

As will have been gathered, the first and principal point in the formation of the Shetland pony is its height. According to the rules of the Stud Book, no Shetland pony can be registered that is over 10.2 hands high. As a matter of fact, the great majority of the island-bred ponies run from 9 to 10 hands. The smaller they can be got without loss of other essentials the better.

In the best-bred ponies the head is small, the countenance pleasant and even intelligent looking, and the neck short, with a fine tapering in to the throttle. The back should be short, the quarters expanded and powerful, the legs flat and fine, with, however, a comparatively large measurement of bone below the knee, and the feet round.

The ribs should be laid on till within two inches of the hip bone. There should be great depth and width over the heart and lungs; the shoulders should be well sloped back from the brisket, and the fore arms and the thighs strong and muscular. Colours can pretty well be anything, but the most popular are blacks, with a considerable number mouse-coloured and a few dark-brown.

The pyeds or piebalds of the olden times are not numerous nowadays.

A point of great importance in connection with the breed, and which makes them extremely valuable as children's ponies, is that they are practically free from vice. A naturally vicious Shetland pony hardly exists. Of course, like other horses, they can be taught tricks, but properly treated they become companions and pets, equally willing, as Mr. Brydon says, to draw a carriage, carry panniers or saddle, or be led by a rein.

Distribution.

Since the founding of the Stud-Book in 1891, a good many studs of the breed have been established in different parts of Scotland and England.

For some time back considerable numbers of Shetland ponies have annually gone to the United States of America, principally for the use of children, a few also going from time to time to the Continent for the same purpose. This demand from America and the Continent has been very welcome to breeders, for it is mare ponies that these outside customers usually prefer, and this is the class which the native breeder has most difficulty, as a rule, in turning into cash, male ponies only being used in the mines.

Male Ponies for Mines.—The preference of the mine manager for male ponies implies no reflection on the capabilities of the mares, which are quite as strong, hardy, and quiet as horses. It is due simply to the fact that in such a limited space as a coal-mine it is practically impossible to have mares and stallions working alongside of each other without trouble and loss of work. Mare ponies going to the United States command readily from £10 to about £15.

"Sheltie."—The term "Sheltie" applied to the ponies is, according to Mr Goudie, derived from the old form of the name Hjaltland given to the Shetland Islands by the Norsemen. But the word "shalt" or "shelt" has for many years been used in Scotland to describe a saddle or other lighter class horse.

MANAGEMENT.

As already noted, the Shetland Islands are for the most part colonies of small holders, who devote part of their time to fishing, the cultivation of the land being mostly done by the women-folks. Spade labour is still the prevailing method of tillage, ponies being used only to a very limited extent for work on the crofts. Their principal function is to carry their owners and their families about as required, and bring home the peats towards the end of the summer. At that season of the year it is no uncommon sight to see strings of ponies coming home from the hill with loads of peats on their backs, either carried in baskets, pannier form, or built on to a shaped frame of wood. These ponies are usually in charge of youths and maidens, who gaily mount the ponies' backs on the return journey.

Most of the small holdings are situated in townships, and while only three to four acres may be cultivated, each township has usually a common hill grazing, or "scathold" as it is called. This may extend to a hundred or more acres. The ponies are usually turned into these common grazings about the month of April, and remain there practically all the summer without further attention.

In the olden times, the owners being generally very poor and not over enterprising, it was the custom to leave the serving of the mares to chance—to any stallion or stallions that might happen to be in the "scathold." But now that ponies have become valuable, the thrifty owner rather turns his stallion pony into cash than allow it to be used at random without payment, and in many cases without thanks. The result is that there is now a shortage of stallions, and many mares pass several years without breeding at all. The more enterprising crofters, however, arrange for a stallion or stallions on co-operative lines, and this custom is becoming general.

The mares, except those that have been brought in and are tethered on the crofts to foal, remain on the "scathold" until the crops are off the ground, when they are brought in and have the general run of the fields. The fresh clean bites of grass which have been preserved round the patches of cultivated land afford the ponies, and the sheep which accompany them, an agreeable and much relished change. The ponies remain there in the open practically the whole of the winter, very often in severe weather being reduced for sustenance mainly to the seaweed which grows on the rocks or is cast up on the beaches of their storm-beaten islands. This the pony eats and thrives upon to a certain extent.

All this time the mares are probably suckling their foals, as the whole of the ponies go together in droves. The result is that, even when the mare is got in foal next season, the strain is too much, and nature intervenes in the form of abortion. Mares kept in this way produce foals only once in two years, and sometimes the interval is longer. The crofters, as a whole, are so poor that they

cannot afford to wean the foals earlier or to keep the mares better in winter. Such spare winter food as they have has to be given to the cattle and sheep, without which the holders could not exist. While the school is an excellent one for ensuring hardiness, it has not led to any great increase in the numbers bred, at any rate by the crofters. In the studs on the larger holdings matters have improved considerably.

Nearly all the ponies exported from Shetland are conveyed by boat to Aberdeen and Leith, and from these centres are distributed over the kingdom.

The Pit Ponies.

The bulk of the male ponies are taken by dealers to the north of England, where they are sold to the various collieries. Mine work is no doubt a hard life for the ponies, but it is not so dreadful as might be supposed. The ponies are well fed and cared for, and they live under it to old ages. Many pathetic tales are told of the attachment of the mine boys to their dumb charges, and *vice versâ*.

A portrait of a typical Shetland pony stallion is given in Plate 21.

THE ASS AND THE MULE.

By high authorities the origin of the varieties of the ass in this country is assigned to *Asinus tæniopus*, a wild species which existed in Abyssinia and other parts in the north-east of Africa. The ass, it is believed, was domesticated before the horse, and this belief is supported by the fact that in sacred history it is referred to much more frequently than the latter.

Varieties of the Ass.—Many varieties of asses are known to exist. While they have all the leading characteristics in common, they vary greatly not only in size but in strength and stamina. Perhaps the best of the modern day asses are to be found in Spain, Italy, Greece, and the old French province of Poitou. The French or Poitou ass is a brown breed, with long shaggy coat, powerful limbs, great bone and feet, standing from 13.3 to 14.3 hands high. Hardly less famous than the Poitou ass are the Catalonian and Andalusian breeds of Spain, which are of great merit.

The Andalusian asses are exceptionally powerful animals. One prize jack of this breed imported from Spain by that enthusiastic patron of the ass, Mr H. Sessions, Wooton Manor, Henley-on-Thames, measured 15 hands in height when four years old, and had great bone and substance in addition. The donkey stallion, belonging to Mr Sessions, which is represented in Plate 25, though only two years old when photographed for this plate, was then 14.2 hands high, his girth being 5 feet 5 inches, while the leg-bone under the knee measured 8 inches.

The Egyptian donkeys, which are practically all grey in colour, have neither the strength nor the stamina of the French or Spanish kinds, and having little value for mule-breeding, are not much used out of their own country. Sometimes a few are imported into Great Britain by visitors who have been struck by their fine appearance as compared with our native donkeys, and they do very well for children and for light classes of work.

A donkey mare of this type with its foal is represented in fig. 701.

In this country, and particularly in Ireland, a large number of donkeys are kept. No systematic attempts have been made to form distinct breeds, and the animals are accordingly simply donkeys and nothing else. They are mainly of the small kinds found in Eastern countries, but long since acclimatised to the conditions as existing here.

In recent times considerable numbers of both French and Spanish jacks have been imported by such enterprising private owners as Mr Sessions, but their influence has not yet reached the common stock.

Uses of Donkeys.—The donkey, in all parts of the world where it is found,

is a most useful animal, especially to the poor man. There is no kind of work to which horses are put that cannot be more or less successfully performed by the ass. In Ireland it is almost a *sine quâ non* to the small cultivator. Not only is it employed to turn over the small patch, but it is usually the only power available for carrying produce to market. In parts of the west of Ireland especially, the spectacle of the farmers' wives driving along in their little donkey-cart is a characteristic feature of the landscape.

The donkey is also largely used for market-garden work, and for hawking vegetables and other produce through the larger towns. The London coster would hardly know himself without his donkey.

Asses are also very largely used by children, both for riding and driving. Asses do not appear to know fatigue, are very easily kept, and, given time, will get through a great amount of work.

Longevity of the Ass.—Donkeys live to great ages. In Brettell's Account of the Isle of Wight, it is mentioned that an ass for the space of fifty-two years drew up the water daily from the deep well at

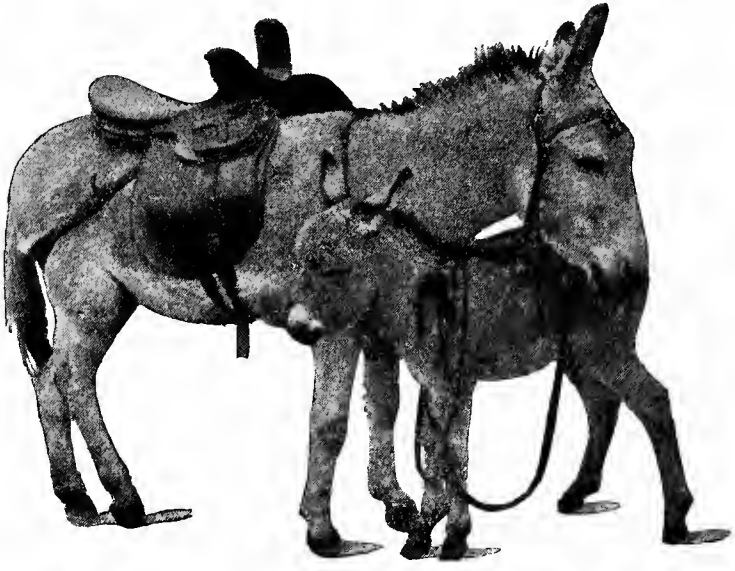


Fig. 701.—*Donkey mare and foal.*

Carisbrooke Castle. The animal might have continued at the operation for considerably longer had it not fallen over the ramparts and been killed. It is stated that up to the hour of its accidental death it was "in perfect health and strength."

The period of gestation in the ass varies from 360 to 375 days, being thus nearly a month longer than in the horse.

MULE BREEDING.

The fact that the horse and the ass breed together is proof of the close affinity that exists between the two. The offspring of this union is a sterile animal known as a mule. Even did the donkey perform no other useful function, it would still be entitled to consideration as one of the agents in the production of the highly useful mule.

In this country the mule is not so well known as it deserves to be. In Spain it is *par excellence* the beast of burden. The larger kinds perform all agricultural and general draught work, while the more slender and finer-boned varieties are extensively used for saddle purposes, being preferred by the rich, in many cases, even to horses.

Mules are also used very largely for a variety of purposes in the United States of America. Before the days of electricity they did nearly all the tram-haulage, besides being extensively employed in agricultural and commercial operations generally. Many of the American mules are as big and powerful as horses. In addition to being powerful, mules are very hardy and tough, and give less trouble, as a rule, than horses, with their legs on hard causewayed streets.

Donkeys and Mule Breeding.—For mule-breeding only the bigger size of donkey jacks are of much use. To serve a mare and get produce of any value the animal must be fairly upstanding and have a large amount of bone. In Spain, Italy, and other countries where mule-breeding is extensively carried on, the best mules are considered to be bred from the jack put to the mare, the produce appearing to follow the mother in the external form. Those bred from female asses are said to be longer in the ears, of less comely form, and duller in temperament. Occasionally trouble is experienced in getting a donkey to serve a mare, but the difficulty is not insuperable, as a rule.

A pair of Poitou mules, which belonged to Lord Arthur Cecil, are shown in fig. 702. These mules took a full share of farm work, day by day, alongside average Clydesdale horses, for a period of twelve years, and their food rations were only two-thirds of what had to be provided to the horses.

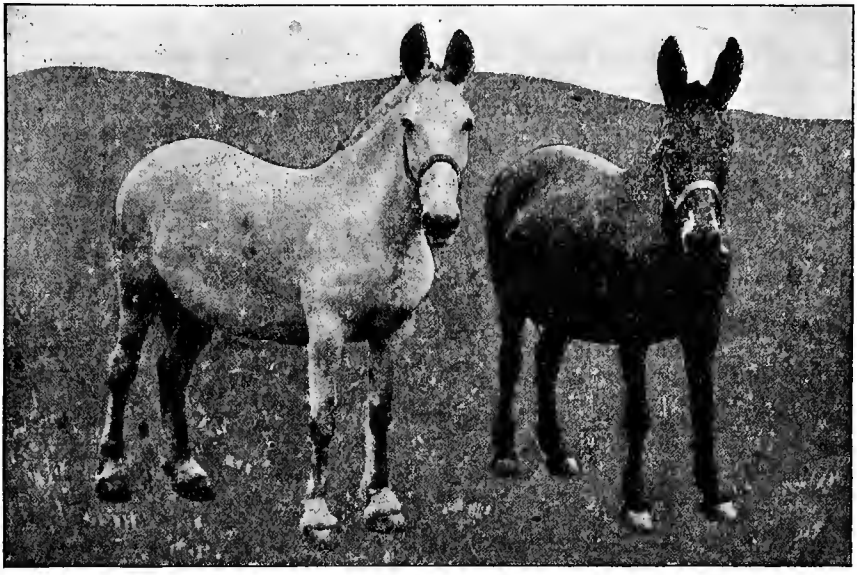


Fig. 702.—*Pair of mules.*

FOREIGN BREEDS OF HORSES.

Comparatively few foreign breeds of horses are known even by name to British agriculturists of the present day. The Arab and Barb races are, of course, familiar to us, and are deservedly held in high repute, for they have played a useful part in the formation of the best varieties of our saddle-horses.

Amongst draught-horses the best known are the French Percheron, now the most highly valued heavy draught breed in the United States of America, the Boulonnais breed of France, and the Flemish breed, which has its home in Belginm. The Flemish breed has contributed its quota to the improvement of British draught-horses.

ABERDEEN-ANGUS CATTLE.

This breed of black hornless cattle is native to the north-eastern counties of Scotland, although within comparatively recent years it has spread largely throughout the different parts of the United Kingdom, and has also secured a firm footing in many of the cattle-raising countries abroad. The outstanding feature in the history of the breed is the remarkable rapidity which has characterised its development. It may indeed be safely said that no other breed of cattle has spread so rapidly to new homes as has the Aberdeen-Angus since its existence as an improved race began. Its rise, development, and progress form a most interesting chapter of British cattle history.

Origin.—Although the origin of our different races of domesticated cattle can only be to a greater or less extent matter of speculation, there is abundant evidence to show that the Aberdeen-Angus breed is of great antiquity. The earliest writings dealing with the agriculture of those districts chiefly recognised as the homeland of the breed, and in which any attempt is made to characterise the different varieties of cattle, show the existence of a black polled race. There is existing legal documentary evidence showing that in the early part of the sixteenth century black hornless cattle constituted in Aberdeenshire an important commercial commodity. Not only in that county, but also in Forfarshire, Kincardineshire, and Banffshire, where the breed was also retained in more or less purity in the early days before its establishment as an improved race, records of the eighteenth century contain numerous references to the "hummel" and "hornless" cattle in these parts. Many of the present-day herds can trace their direct descent for considerably over a century.

Early Improvement.

Mr Hugh Watson.—The first great improver of the breed was Mr Hugh Watson, Keillor, Forfarshire. His father had been a breeder of black polled cattle as early as 1735, but the systematic improvement of the breed may be dated from the year 1808, when, as a young man of eighteen years of age, Hugh Watson entered the farm of Keillor in the old territory of Angus. There can be little doubt that the wonderful success which was attending the efforts of the Brothers Colling, especially those of Charles Colling at Ketton, in the improvement of the Shorthorn breed, spurred on the young Forfarshire farmer, who indeed lived for a time as a student with Charles Colling. General Simson of Pitcorthie in Fifeshire was then buying at great prices some of the products of the Ketton herd, while the tidings of the sale of the Shorthorn bull "Comet" at Mr Colling's sale in 1810 for a thousand guineas must also have proved an incentive to Mr Watson to persevere in the improvement of the native cattle of his county. He had many co-workers, such as Mr Bowie, Mains of Kelly, who was born in 1809; Mr Fullerton, Mains of Ardovie; Lord Panmure, Sir James Carnegie, and the late Mr Ferguson, Kinochtry. But it is especially by Mr Watson's persistent efforts that the greatest services were done to the interests of the breed while yet in an embryo state.

Mr William M'Combie.—In the north of Scotland an outstanding name in Aberdeen-Angus history is that of Mr William M'Combie, Tillyfour, who, along with Mr Watson, took a great part in the establishment and early development of the breed. Mr M'Combie was only three years of age when Mr Watson began his work at Keillor, but by 1830 he owned a breeding herd, and about 1848 he gave himself up entirely to the cause of Aberdeen-Angus breeding, or what was then styled Polled Aberdeen cattle as distinguished from Polled Angus, although the necessity for this differentiation soon passed away.

About that time, near the middle of the nineteenth century, the black polled breed was threatened with complete extinction, as the result of the crossing craze which

followed upon the introduction of the Shorthorn to the north of Scotland. As a matter of fact, one northern race of cattle, the Aberdeenshire Horned breed, entirely disappeared as the direct result of this new system of breeding. Mr M'Combie is the recognised rescuer of the polled breed at this juncture, and by setting himself to bring out the great feeding capabilities of the breed, he undoubtedly gave it a new lease of life. From this point the history of the breed has been one of continuous and unbroken progress.

Sir George Macpherson Grant.—In more recent years the central figure in the improvement of the breed was the late Sir George Macpherson Grant, Bart., of Ballindalloch, who vastly advanced the cause of Aberdeen-Angus breeding and perfected the type which had been evolved by those who went before him.

Early Show Successes.—Although as early as 1867 Mr M'Combie, after repeated trials, managed to secure the blue ribbon of the Smithfield Fat Stock Show, thereby greatly advancing the interests of the breed, there is little doubt but that a most important agency in the spread of the breed was the French International Exhibitions. These exhibitions, from 1856 up to 1878, were taken part in by a number of leading breeders, such as Mr Bowie, Sir George Macpherson Grant, Mr Walker, Portlethen, and Mr M'Combie; and great successes were won both for feeding and breeding stock.

It was in the year last mentioned (1878) that the greatest victory of all was won by the Aberdeen-Angus breed, and there was no doubt a very direct connection between this success and the great and remarkable demand which was about that time being experienced from America for cattle of the breed. A prize given by the French Government for the best animals for breeding purposes, in the sections other than French, was won by Mr M'Combie, and Sir George Macpherson Grant was reserve. But the greatest trophy of the show was in the competition for the best group of beef-producing animals, when all varieties of European cattle competed together. The bench of judges, by twenty-four votes to seven, decided in favour of the representatives of the Tillyfour herd, and thus both the fat stock championship and the championship of the breeding classes went to the Aberdeen-Angus cattle. This proclamation to the world of the superiority of the Aberdeen-Angus breed in the realm of beef-production gave a great impetus to the growing popularity of the cattle not only in this country but likewise in America.

Characteristics of the Breed.

Record as Beef-Producers.—The breed possesses valuable dairy qualities, which are capable of greater development. Many strains of the breed are found to be exceptionally heavy milkers, and the milk, in the various tests that have been made, has been found to be very rich. The breed has, however, been all along cultivated primarily for its beef-producing properties. The aim which Mr M'Combie ever kept in the forefront was the production of size, symmetry, fineness of bone, strength of constitution, and disposition to accumulate flesh. Keeping these objects in view, Aberdeen-Angus breeders have been able to evolve a type of animal which holds an unrivalled position in the estimation of feeders and butchers. The remarkable success of the breed at the leading fat stock shows of the country has also tended to greatly increase the admirers of the breed, and to enhance the reputation of the cattle as grazers.

Graziers on a large scale have borne testimony to the fact that cattle of the breed give a better return for the same amount of keep than any other kind of cattle, and the statistics of the Board of Agriculture and Fisheries show that both in Scotland and England enhanced prices are paid by butchers for Aberdeen-Angus cattle and their crosses as compared with other breeds, while on the London cattle market it is a generally recognised fact that this class of cattle sell first and sell dearest. The reason of this is that the Aberdeen-Angus produce beef of the finest quality, and have the best cover of meat on the most valuable parts. It may be that the beautifully rounded form set on short legs may be deceptive to the eye, and may cause the cattle to bulk less largely in appearance than

some other breeds, but the well-filled rump and loins, the thick cover along the back, and the long well-filled-out quarters appeal at once to the butcher, and constitute them his primest favourites. Cattle of the breed are found to feed very smoothly, unlike some other breeds which are much more apt to run into lumps and bumps of fat, which are absolute waste. The breed holds a record of 76¾ per cent of dead- to live-weight, and in addition to great returns at the block, butchers find that the flesh of cattle of the breed is admirably mixed and beautifully marbled throughout.

A breeder of extensive experience has put the following on record, speaking of Aberdeen-Angus cattle: "I may state that my resolve to keep this particular breed is the result of having carefully watched the breeding, feeding, and general health of cattle for some years. Having for many years been engaged in a large veterinary practice with special opportunities for forming an opinion on the merits of the different breeds of cattle from a professional point of view, and having for a number of years been a farmer and feeder of stock, I have had not only my own farming experiences to guide me, but also the cattle market, and the health of the large and varied cattle population of this district—the result being that I believe this breed of cattle stands pre-eminently forward both to the farmer and the butcher as being hardy and healthy, good milkers both in quantity and quality, easily fed, good beef-producers, coming early to maturity, and highly prized by butchers."

Reputation in America.—In America this same characteristic has been brought out, and has led to the phrase "market-toppers" being applied to the Aberdeen-Angus cattle. It is a rather striking fact that for a space of about twenty years the top price in the Chicago Meat Market has been made each year by cattle of Aberdeen-Angus breeding. Here, too, it has been found that no other class of cattle put on flesh so quickly in proportion to what they eat as Aberdeen-Angus cattle do, and few breeds can stand the cold winters so well. They give most satisfactory returns both when rustling on the scanty herbage of the ranch and when foraging on the luxuriant pastures of the fertile farms. A representative of one of the largest packing firms in America stated that "in buying cattle for our trade in the United States, and especially for export, we give the preference to Aberdeen-Angus steers. These well fattened will dress from one to two pounds more per hundred pounds of live weight than either Shorthorns, Galloways, or Herefords. Although the Aberdeen-Angus may appear very fat, they will show more lean meat and be less wasteful for the retail butcher than animals of any of the other breeds above mentioned, and the meat itself will show a better and richer grain, and is more juicy."

Records in Fat Stock Shows.—As regards the fat stock show record, it will be sufficient to deal with the two greatest shows of the world—the London Smithfield Show and the International Fat Stock Show of America, held annually at Chicago. At the London Show, where eleven different breeds of cattle compete, Aberdeen-Angus cattle during the fifteen years, 1894-1908, won the championship upon eight occasions, while a cross showing Aberdeen-Angus lines of breeding has won it once. On the occasion of the other six shows, the Aberdeen-Angus breed has provided three reserve champions, and crosses of the breed have also produced four reserve champions. In other words, at these fifteen shows pure or cross Aberdeen-Angus cattle each year provided the champion or the reserve champion. This constitutes a record that is quite unique. In the case of the Chicago Show, which was begun in 1899, the championship in the first nine years was won upon five occasions by Aberdeen-Angus cattle, twice by Herefords, once by a cross, and once by a Shorthorn. This, coupled with the equally successful record of the breed at the other fat stock shows throughout Britain and America, demonstrates clearly that the great popularity attained by the breed has been built on a sure foundation.

Carcase Competitions.—The breed has also won many of the higher honours in the carcase competitions at fat stock shows, the great return given by cattle with a dash of Aberdeen-Angus

blood in them leading to their being largely represented in this department of the show.

Weights.—Animals of this breed attain heavy weights at an early age. At the Smithfield Show in 1908 the steers of the breed under two years old weighed alive from 11 cwt. to 14 cwt., the exact age of the heaviest animal being 1 year and 11 months. In the class for steers between two and three years old the live-weights ranged from 15 cwt. 1 qr. 14 lb. for a steer 2 years and 9 months old to 16 cwt. 1 qr. 27 lb. for a steer one month younger. The live-weight of a heifer of the breed at the age of 2 years and 11 months was 16 cwt. 1 qr. 20 lb.

Prepotency of the Breed.—An outstanding characteristic of the breed is its remarkable prepotency in imparting its properties to its offspring. This is seen in the demand for polled cross oxen for feeding purposes, and by the extent to which Aberdeen-Angus blood is represented in the cross sections at the fat stock shows. So prepotent are bulls of the breed that it is found that quite 75 per cent of the calves come black and hornless, even when the cows belong to a pronounced horned breed.

A breeder in Ireland writing of the breed says: "This breed of beef-producing cattle has made rapid progress in the Sister Isle, and its crosses, whether made with the Shorthorn, the Hereford, or the native Kerry and Dexter cattle, are amongst the most useful stores for the feeder to buy that can be produced."

In the case of a large dairy farm where Ayrshire cows were kept, the owner, to improve his calf stock, introduced Aberdeen-Angus bulls. The result was that 90 per cent of the calves were black and hornless, and fetched greatly enhanced prices when sold. Again, an American experiment showed that where an Aberdeen-Angus bull was used on fifty horned cows there was not a single horned calf, while 95 per cent of them were black. Even when used on the long-horned Texan cows, bulls of the breed produce a very large percentage of black and hornless calves. On the great ranches of America the breed has proved to be most prolific.

Influence of the Breed in England.—A writer in *The Times*, in November 1908, in commenting upon the character of the cattle exhibited at English fat stock shows, referred thus to Scottish polled breeds: "The Norwich [Fat Stock] Show of last week provided an instructive illustration of the popularity of the hornless black breeds of the north, especially for crossing with the English varieties. Of the 110 head of cattle stalled at Norwich, 12 were red polls and 15 shorthorns, and deducting these 27, which, of course, were exempt from the influences of the black breeds, 83 remain, and of this number 53 were either black or blue-grey. Thus, nearly 64 per cent of the exhibits, other than red poll and shorthorn, revealed the characteristics of the Scottish black poll breeds, the Aberdeen-Angus greatly predominating. The latter influence was as marked in the county and butchers' classes as in the others, and it was the general opinion among graziers present that the change, as compared with past years, is beneficial to the eastern counties, the compact, short-legged, thick-fleshed bullocks of the present time being much more economical feeders and more popular with butchers than the leggy, plain steers they have displaced."

Early Maturity.—The property of the breed to mature early has already been indicated. In the early days Mr M'Combie brought out this feature, his champion group of six at the French Exhibition being with one exception only two-year-olds. In later times, as showing that there has been no falling off in this respect, it may be recalled that the Aberdeen-Angus is the only breed that has produced at any of the leading British fat stock shows a champion animal at one year old. It is also a rather interesting fact, in view of the chief aim of the Smithfield Club to encourage early maturity, that the first occasion in the history of the Club upon which the championship was taken by a two-year-old, the successful animal was of the Aberdeen-Angus breed.

Prices.—During the twenty-five years, 1882-1907, average prices for the breed have ranged from £23 to £25, although early in the 'eighties, when the American "boom" was being experienced, the average was from £45 to £55. The

highest single price in this country at a pbulic sale is £504 for a bull-calf from Ballindalloch. In America, a bull bred by Sir George Macpherson Grant sold for £1820.

Points of the Breed.

In the formation of Aberdeen-Angus cattle, well-defined points are kept in view. In the case of the bull, there should be sought both size and quality. The head should be neatly put on, and the throat clean. The distance between the eye and the nose should not be over long, and the eyes should be bright and prominent, with a good breadth between them and surmounted by a good, high poll. The neck should be of good length, and clean—a little but not over full on top; chest full and deep; legs short, but not so as to give the animal a dumpy appearance; bone clean and free from coarseness; shoulders not too full, and top free from sharpness, but not over broad; back level and straight; ribs well sprung; deep barrel; well ribbed down towards hook; full behind shoulder; hooks level, but not too broad for other proportions; and well and evenly fleshed to tail; twist full and long and well fleshed down, but not protruding behind; tail of moderate thickness and hanging straight; hair soft and plentiful; skin of moderate thickness and mellow to the touch; body fully developed, and the animal when in motion to have a blood-like look and style about him.

A cow of the breed should differ from a bull in the head in having, instead of a broad masculine-looking head, a neat feminine-looking one. The ear should also be of good size, with plenty of hair in it; the neck well put on, clean and straight, and without any prominence on the top or abrupt hollow where it joins the shoulder; the top of the shoulder sharper than in the bulls, and the shoulders themselves thinner.

Present Position of the Breed.

The leading position which the breed has taken at the fat stock shows, both when shown pure and in the form of crosses, has led to a marvellous growth in the numbers of the breed both at home and abroad. As indicating the progress which has been made, the following facts may be mentioned. In the first volume of the *Polled Herd-Book*, published in 1862, there were eighty-three owners of animals, and in the early volumes the names of only two English breeders and two Irish breeders appear. In 1879 a meeting was held for the formation of The Polled Cattle Society,—changed in 1908 to The Aberdeen-Angus Cattle Society,—and at the first annual meeting in the following year the membership totalled 56. By 1908 the Society reached a membership of about 530, of which about 120 resided in England and 70 in Ireland. In volume xxxii. of the Herd-Book,—which brought the registered numbers up to 27,662 bulls and 43,173 cows,—there are 2837 entries.

The Breed in Canada and United States. — Although the first breeding herd was established in Canada only in 1876, and in the United States about a couple of years later, the breed has in the course of the thirty intervening years spread widely in these countries. As an indication of the demand for the breed in the early 'eighties, it may be remarked that in 1882 there were landed on North American soil 104 Shorthorns, 173 Herefords, 222 Galloways, and 586 Aberdeen-Angus. Within a space of two or three years over two thousand head of cattle of the breed had been introduced into America.

In the first seventeen volumes of the *American Aberdeen-Angus Herd-Book* 112,500 animals were registered, and the 120,000 entries in the seventeenth volume represent over 2000 breeders. The American Aberdeen-Angus Breeders Association was instituted in 1883, and when the first volume of the Herd-Book was issued in 1886 the membership was only 112. It is thus seen that the progress of the breed there has been very rapid.

The Breed in other Countries.— In several other countries the breed has secured a firm footing. In the case of Argentina there is a steadily growing demand, for this breed is found to be pre-eminently suitable in the northern districts on account of the thrifty and hardy properties which characterise it. Aberdeen-Angus cattle were first introduced to the Argentine about 1876, and

there are now a good few herds of the breed in that country, though for the most part the bulls of the breed have been used for the grading up of the native cattle of the country. In the pastures of Argentina, cattle of the breed are found to thrive excellently.

In several of the Australian Colonies the breed is also largely represented. As early as 1863 Aberdeen-Angus cattle were introduced to New Zealand, and the Aberdeen-Angus is now the second most numerous breed in that country. During recent years large numbers of the cattle have been imported to South Africa, and recent advices state that bulls imported into that country, and especially into Rhodesia and the Transvaal, are giving excellent results. To various other countries, such as France, Spain, Germany, Sweden, Russia, and even to Demerara, India, and China, representatives of the breed in small numbers have been introduced, mostly for crossing purposes.

MANAGEMENT OF ABERDEEN-ANGUS HERDS.

Systems of management in Aberdeen-Angus herds vary considerably. They are influenced to some extent by locality and climate, by the accommodation afforded by the farm-steading, and also by the consideration whether the chief end in view is the rearing of bulls for sale. Ages of Aberdeen-Angus cattle are reckoned from 1st December, and the principal calving months accordingly are December, January, February, and March, the object being to get the calves as early in the year as possible. Especially is this of importance in the case of bull-calves.

Calving.—At the calving time each cow is placed in a loose-box, or given a whole stall to herself, all depending on the accommodation that is available. A week or two prior to calving time the quantity of turnips fed to the cows is reduced, and they are allowed a soft feed, such as bran, once a-day. The decreased ration of turnips is continued for about a week after calving, the bran mash being also continued, when the cows are generally placed again on their full feed of turnips and straw.

Calf-rearing.—The calves suckle their dams, and in many herds a couple of calves are put to one cow, the cow sthus relieved being hand-milked to supply the ordinary requirements of the farm. The calves are, as a rule, tied up beside the dam, but in several large herds they are allowed to wander about in the open area behind the cows, being allowed access to suckle four times a-day. The breeding byre, unlike the byre for the feeding cattle, should always be a single one.

When about three months old the calves are allowed a small supply of hay and sliced turnips with a little linseed cake, although in a great many well-managed herds they get nothing beyond the dam's milk until they are put out to grass about the month of May. The bull- and heifer-calves are put into separate fields, and where the pasture is poor, and it is wished to keep them going on, the bull-calves receive about 2 lb. of cake per day. When they are from seven to eight months old the calves are gradually weaned, and thereafter put out to grass again so long as the weather permits.

In any case they are allowed plenty of room for exercise. In a few cases the heifer-calves get a little cake each morning, which is found to be of great value in helping them to retain the calf flesh. In the great majority of cases, however, nothing is given them beyond turnips and straw.

The bull-calves, where the necessary accommodation can be got, are put up two by two in loose-boxes. In large herds this cannot always be done, and the practice then is to put them into a court. Their principal diet consists of turnips and straw, with about 3 lb. of cake per day, and a hot mash of bran and barley twice a-day. But on this point treatment varies considerably, and in many cases the allowances are much less liberal. The bull-calves are sold off in the spring when about a year old.

Young Heifers. — The heifers are kept out all summer, being again, when the weather becomes severe, housed up in the open courts or in the byre, according to available room. The only feed is turnips and straw, so as to keep them in natural condition for breeding.

The best mating season is about the month of March, and, as a rule, heifers are not served until they are two-year-olds. Breeders prefer to have all their females settled in calf before they are put out to grass.

Stock Bulls.—Stock bulls should be kept in healthy condition by avoiding too heating or heavy feeding. They should be given plenty of exercise, and it has been found that the most beneficial form of exercise is to walk the bulls along the hard road for about an hour each day. Turnips and straw or hay form the principal foods during the winter, and as the mating season approaches an allowance of dry crushed oats is frequently added.

Ballindalloch Herd.

In the course of his history of the Ballindalloch herd the late Mr Camphell Macpherson Grant gave the following notes on the system of management:—

"The principal calving months are December, January, February, and March, although calves are dropped all the year round. When due to calve each cow is allowed a double stall, and the calf when dropped is tied at the opposite side, while a strong bar, angled lengthwise down the stall, prevents any risk of accidental injury to it.

Calf-rearing.—"When strong enough and able to take all the milk the calves are allowed to move at will through the byre, their beds being made up for them behind their dams. A trough with cake and sliced turnips, as also a rack with good, sweet hay, is always within their reach. The bull-calves when at grass are kept separate from the cow-calves, and have an allowance of cake daily. They are gradually weaned when six to seven months old, and are then, so far as accommodation permits, placed two together into loose-boxes with an outside court for exercise. They are liberally fed on yellow turnips and hay or oat-straw, with an allowance of cake, care of course being taken not to overfeed.

"Heifer-calves are treated in much the same way, but get no cake on the grass; and they run in the covered courts during the winter, getting a fair allowance of yellow turnips, good oat-straw, and 2 lb. bruised cake each day.

Winter Treatment in the Herd.—"As soon as the nights begin to turn cold, all the cattle are housed at night and turned out during the day. When finally brought up for the winter, at a date determined by the character of the season, the cows get a fair quantity of turnips twice a-day, with plenty of oat-straw, but get no artificial food except for a fortnight before and after calving, when they get 2 lb. of cake daily; and during the fortnight after calving, in addition to the cake, a bran mash daily, which twice a-week contains a little nitre. The two-year-old heifers have nothing but turnips and straw. Except in quite an exceptional case heifers are not served until they are two-year-olds."

Pictstonhill Herd.

Mr W. S. Ferguson, Pictstonhill, Perth, writes: "I aim at having the cows in fairly fresh condition at calving. This is done by giving them straw and turnips in limited quantity, in covered courts, in autumn and winter after the grass is done. The cows are tied in stalls when they show signs of calving, and when the calf comes it is tied not far from the dam. It is let to her four to six times a-day to begin with, and afterwards three times a-day, when the calf takes all the milk freely. Great care is exercised at the beginning to take all the milk from the cow. Some calves cannot take nearly all the dams can give, and if not milked dry nature seems to meet the case by drying up the cow to suit the requirements of the calf, and the cow will not then come back to milk when the large, grown calf requires more. One of the most important matters the cattlemen have to attend to between calving and grazing time is to keep the cows in full milk. Every cow requires different treatment: some more food and some less. When a calf is becoming too fat, as sometimes may happen, it is not permitted to take all the milk from its dam. After the calves are two months old they get some cake, meal, and pulped turnips, but not much, as we rely mostly on the milk.

Aberdeen-Angus Cows as Milkers.—"It is a mistake to suppose that Aberdeen-Angus cows are not good milkers. They give milk, as a rule, according to

the treatment they receive; and I find that when passed on to the dairy, as I sometimes do, they give as good an account of themselves as any excepting Ayrshires.

"The cows after calving and up till grass time get mostly turnips and straw, along with a drink of bran and meal once a-day, while if an individual beast begins to look thin and dry she may get a bit of cake extra.

Calves.—"The calves go with their dams at grass. The heifer-calves get nothing but their mother's milk and what they pick up on the field, but after a short time the bull-calves are trained to eat cakes and meals. The calves are weaned when about seven months old, the heifers going anywhere at little expense, and the bulls to folds and boxes to be trained and fed for sale in the following spring. According to modern ideas it is not easy to overdo a bull-calf to sell him as a yearling, but care must be exercised to keep his feet and appetite always in good order. This is where the expert cattleman comes in, for fixed rules are of little use.

Objections to Forcing.—"But the modern system of forcing young stock for showing and selling is a mistaken one. By it many young animals are impaired in growth and health, and are not in the end as useful as are animals that are kept in moderate growing condition. I never put too much flesh on a calf intended for breeding purposes, and if sometimes I am constrained to put a good, young bull in prime show order I always grudge it. I seldom do it till after he is two years old, and then he can stand it better. My efforts—as were those of my father before me—have been to keep a good, healthy, presentable herd at as little expense as possible, and to make the cattle leave a profit.

"The heifer-calves after being weaned get a small allowance of cake or meal for the first winter, along with turnips and straw. After that nothing in the way of short concentrated food is given them until they reach the cow stage. Of course this does not apply to a few females now and then put into training for show purposes. With these few it is a case of feed as hard as you can without making them patchy."

Mulben Herd.

Mr John Macpherson, Mains of Mulben, Banffshire, states that his cows, except an occasional animal for showing, receive very little artificial food,—turnips and straw during winter, and grass in the fields during summer, being all that is necessary to keep them in good healthy breeding condition. For a week or two after calving, or if at any time any animal seems to be down in condition, a little linseed-cake is given.

Calves.—The calves are all suckled, bull calves singly, and heifer-calves in pairs on good milking cows. With the exception of a little cake for a few weeks at weaning time, the heifer-calves get no extra keep.

The bull-calves, being intended for early sale, require more attention. After the grass begins to fail they are taken into a court overnight, and get some tares and a small allowance of linseed-cake. Bran and feeding-meals mixed together, and scalded with boiling water, are fed to them in boxes, the food being thinly scattered on the bottom until they begin to eat it. During the day they go to the field, but they soon learn to gather about the gate to get in. The cows are left in the field, and cows and calves are thus accustomed to be separated, so that when the final weaning time comes there is far less noise and trouble than there would otherwise be.

Heifers.—The earliest and strongest heifers are served when fifteen or sixteen months old, so as to get them to calve when about two years old. Mr Macpherson has found that when the animals are strong and fairly well kept, although they may take a little longer time to mature, the ultimate growth and size of the heifers thus served are not very much affected, while their milking qualities are improved.

The stock bulls are well kept and regularly exercised, and during the mating season a little extra grain is added to their feed.

The whole steading is thoroughly cleaned and disinfected every summer, and the byres and courts are frequently sprayed with a solution of Jeyes' fluid.

Spott and Inverquharity Herds.

Writing of the management of the herds at Spott and Inverquharity, Mr Archd. Whyte states that all cows in calf go out every day to rough pasture till the calving time comes on. After calving they are kept in till early spring, when the weather becomes favourable. During winter the cows are fed very moderately on turnips and straw.

Calves.—As soon as practicable, the cows and calves are turned out to pasture, the bull-calves being weaned in August and the heifer-calves a little later. After weaning time the cows remain outside till the end of November, and then only get shelter overnight. Bull-calves, after weaning, go out to clover during the day, being taken in at night to a bite of hay and cake. Thereafter they are put gradually on to turnips, &c., getting out for an hour every day for exercise. Heifer-calves get moderate keep. They are out every day, and are allowed a few turnips, straw, and a little cake night and morning.

Heifers and Cows.—Yearling and two-year-old heifers get very ordinary fare—when on grass only what they can gather. This applies also to cows with calves at foot. When on grass they get nothing extra, and when weaning time comes round they are always in fine condition.

Stock bulls get ordinary fare all the year round, a little cake being added if other keep be scarce.

The farms being situated in a very high-lying district, winter keep is never plentiful, but cattle keep themselves in wonderfully good condition on very small rations.

Dr Clement Stephenson's Herd.

Dr Clement Stephenson, Balliol College Farm, Newcastle-on-Tyne, writing on the subject of herd management, states that up to a few days before calving the cows may remain in their stalls, and for calving should be isolated in a box or stall. In no case should a cow be allowed to calve in a byre beside other in-calf cows.

Calves.—Calves should suckle their dams, and when in the byre should be tied up in such a way as to allow them to get a fair amount of exercise. A large piece of rock-salt, and sometimes chalk also, are kept in the racks, so that old and young may lick them when they choose.

As soon as weather permits cows and calves are put to grass, the bull and heifer calves being put into separate fields. Should the dams of the bull calves begin to fail in their milk-supply, the calves should be given a small allowance of cake. Great care should be taken in the breaking-in and training of the calves. From weaning time till turning-out time in the following spring the calves should be well attended to, and their food must be of good quality. They do not want coddling up in warm places, but should be kept in covered folds which are well lighted and ventilated, and in which they have plenty of room to move about. Twice a-day they should be let out into a yard to scamper and play about. They should be accustomed to being handled, and kept clean with brush and comb.

Heifers.—After being turned out at May-day the heifers need not be brought into the house again until next spring, and then only for service. A shed in the field into which they can go if inclined, and oat-straw in the winter, are all they require, but if it be thought advisable to give them cake it should be linseed-cake.

Bulls.—Stock bulls should be well fed—not made fat, but kept in vigorous condition. When in free use, their ordinary diet should be supplemented by stronger, more nitrogenous food, such as bean-meal or crushed oats. The bull-house should be well ventilated, and have a walled exercise-yard adjoining.

When in the house a sloppy mash, sweet hay, and a few turnips are all the cows require. Cake is not necessary, nor is it advisable to give it, at any rate until the cows are again safely settled in calf.

Preston Hall Herd.

Rev. C. Bolden, Preston Bisset, Buckingham, writes: "I endeavour to get cows and heifers to calve in December and January. They lie out in the fields until within a week or a fortnight of calving, when they are housed. A week

after calving they go out for three or four hours daily in all kinds of weather. In ordinary seasons yearling heifers are left out all winter, getting hay when there is snow on the ground or during hard frost. In some seasons I am obliged to put them in open yards to prevent damage to pastures, as my land in Bucks, being heavy clay, treads into holes in very wet weather. I find that yearling heifers do best lying out all the year, and I generally manage to keep a field fresh with plenty of grass for them during winter.

"Calves are gradually weaned in October, and put into covered yards in November, the heifer-calves getting hay and roots and 2 lb. of cake daily. The bull-calves get more cake with meal, and are fed on as well as possible with a view to sale in February, but I object to any free use of condiments or forcing them into overfed condition, as this, I believe, shortens the period of their usefulness as sires, and in some few cases may render them uncertain, or possibly useless, as stock-getters during their first year of service. My covered yards have a hard level bottom, either paved or solid gravel. They are frequently cleaned out, and no accumulation of muck is allowed in them."

An Irish Herd.

Mr H. Bland, Kilquade, Greystones, County Wicklow, Ireland, writes: "Owing to our exceptional climate it is possible to keep our cattle under the most natural conditions. The cows are out at grass all the year, and only come in, say, a week before calving. We keep them tied up after calving, with their calves behind them, the calves going out daily in a sunny court. About the first of May all get to grass. We take up the calves about the last week of October, and feed the bulls and such females as we decide to exhibit. Stock bulls we keep out all the year unless in very bad weather.

"Tuberculosis is unknown, and the veterinary surgeon seldom visits us. We keep the byres and boxes in a very sanitary condition. The cattle always have access to salt. In hot weather we spray them with dip to keep off the warble-fly."

A portrait of a noted Aberdeen-Angus bull is given in Plate 36, and of a characteristic cow of the breed in Plate 37.

GALLOWAY CATTLE.

Early History.—This breed took its name from the province of Galloway, which at the present time includes only the counties of Kirkcudbright and Wigtown—at one time known respectively as the Stewartry and the Shire of Galloway. At a very early date the term Galloway was applied to almost the whole south-west of Scotland lying south of the Clyde, and the only cattle then kept in that extensive area were of this polled breed. Indeed they were often termed "Carrick cattle," from the title of the southern division of the county of Ayr. Ortelius, the celebrated geographer, says: "In Carrick are cattle of large size, whose flesh is tender and sweet and juicy." In very ancient times Cumberland was under the same rule as Galloway, and over the northern counties of England adjoining the Border Galloways were long the native breed.

Even in the area comprised in the present restricted province of Galloway the breed has been to a great extent supplanted by the Ayrshire dairy breed, and in the north of England the cosmopolitan Shorthorns have made a serious inroad on their territory.

There was a time in the distant past when sheep and not cattle were the principal live stock kept in Galloway. The breed of sheep peculiar to Galloway were celebrated for the fineness and superior quality of their wool. There is an adage of unknown antiquity—

> "Kyle for a man,
> Carrick for a cōo,
> Cunningham for butter and cheese,
> And Galloway for woo'."

Early Export to England.—What led to the very early improvement of the breed of Galloway cattle, and to a great increase in their numbers, was a demand for them which sprang up from Norfolk and other south-eastern counties of England. Before this southern trade for lean cattle developed there was little demand for beef from a province so far removed from any great centre of population. This outlet for the native cattle had been opened up by the middle of the seventeenth century; for the Rev. Andrew Symson, Episcopal minister at Kirkinner in Wigtownshire, in his work entitled *A Large Description of Galloway*, published in 1682, states that "the bestials are vented in England." He also mentions that Sir David Dunbar of Baldone kept in his park, extending to about 2½ miles in length, both summer and winter, about 1000 head of Galloways of different ages, and that he was in the habit of selling from eighteen to twenty score of the four-year-olds annually to dealers who took them to the English fairs. This trade in lean cattle led to a great increase in the breed, for through it breeders received large sums — a new experience, compared with the times when little money was received for that class of live stock from any outside quarter. It is said that there was an old proverb in Galloway that a good farmer would rather kill his son than a calf, which is a strong form of expressing the value which those engaged in the cattle industry put on their bovine stock.

This trade had become so large a century ago that from 20,000 to 30,000 three- and four-year-old Galloways were annually sent in late summer and in autumn from Dumfriesshire and Galloway to England—principally to the counties of Norfolk and Suffolk. They were taken on foot in droves, iron plates being put on the hoofs of such as proved tender-footed during the long journey. They were finished on the rich pastures in these counties, and disposed of in the London market.

The Norfolk purchasers, tiring of paying so much money to Scottish farmers for lean cattle, adopted the plan of extending their own breeding herds; and as they wished to have them after the type of the Galloways, they took South Galloway bulls of a colour similar to that of their own native red polled cattle. In this way the present excellent breed of Norfolk Red Polled cattle claim descent from the Galloways on the one side.

While this extensive and lucrative trade led to a great increase in breeding in the south-west of Scotland, it also gave a powerful stimulus to the improvement of the breed. In fact, the Galloway was among the first, if not the very first, breed which was actively and systematically improved in Great Britain. The quickened demand and the greatly enhanced prices naturally induced the breeders to strive energetically to supply their southern customers with an improved type of beast which would respond to the richer and more generous keep they got in the south.

Origin.—The origin of the breed is lost in the mists of antiquity. But no authority of any weight has ever thrown a doubt on the claim that it is a pure breed, and that the improvement was not brought about by the introduction of alien blood from any quarter. Aiton, in his *View of Ayrshire*, written for the Board of Agriculture in 1810, says that "the breed was brought to its present improved state by the unremitting attention of the inhabitants in breeding from the best and handsomest of both sexes, and by feeding and management."

Improvement of the Breed.

Early Improvers.—No man stands out conspicuously among his fellows as having been chiefly instrumental in improving the Galloways at the early period of their history. Smith, in his *Survey of Galloway*, written in 1810, says: "Among Galloway farmers have arisen no enthusiasts in the profession, none who have studied it scientifically, or dedicated their talents almost exclusively to this one object. No Bakewells, no Culleys, no Collings have yet appeared in Galloway, who with a skill, the result of long study and experience, have united sufficient capital, and by the success of their experiments have made great fortunes and transmitted their names to the most distant parts of the kingdom."

That the production of the same ideal

type of Galloway was aimed at a century ago as at the present day is proved by comparing the points or characteristics of a typical animal of the breed given in Aiton's work, published in 1810, and the statement of characteristics which was drawn up by the Council of the Galloway Cattle Society in 1883 and which is given below. It is somewhat remarkable that there is a very close resemblance between the two descriptions.

Later Improvement.—The improvement effected since the commencement of the second quarter of the nineteenth century has been great, and it was the result of much enterprise and skill. Landowners and tenant-farmers vied with each other in this commendable work, and the latter received great encouragement and assistance from the former. In many instances on both sides of the Border proprietors purchased the best bulls which could be got and gave the use of them to their tenants. Sir James Graham, Bart., of Netherby, the celebrated statesman, had a novel but influential method of encouraging and assisting his tenants in their efforts after improvement. Instead of money or medals, bull-calves from his own very superior select herd were given as prizes to the tenant who showed the best lot of five yearling Galloways and as many two years old, the choice of the prizes in kind being given to the winners according to their order in the prize list. This was recognising past and contributing to future success in an admirable manner.

There is one man who stands out as having bred a number of bulls by one sire from which are descended almost all the best Galloways in the Herd-Book—namely, Mr George Graham, a tenant-farmer at Riggfoot in Cumberland, who has been called by "The Druid" in *Field and Farm* the "Black Booth of Cumberland and the Border Counties," from his having done for Galloways what Booth did for Shorthorns. The sire above alluded to was "Cumberland Willie" 160, bred by Mr Sproat, Borness, in Kirkcudbright. There were bull sales by auction established at Lockerbie and Castle-Douglas at the middle of last century which were the means of diffusing the best blood in all districts where pure Galloways were bred. Males of the choicest lineage and of the greatest individual merit were entered for these sales, and the introduction of railways provided a ready means of getting them conveyed to their respective destinations.

About this time the rapid extension of dairy farming and the great increase in Ayrshire cattle threatened, if not to completely supplant the breed in Galloway, at all events to restrict its numbers as well as to endanger its purity. What has been termed "a dairy wave" swept over the south-west of Scotland, to the detriment in various ways of the native polled breed.

Herd-Books.

The improvement of the breed has been greatly promoted by the establishment of the *Galloway Herd-Book*. From the outset the editor of the Herd-Book has been the Very Rev. John Gillespie, LL.D., Mouswald, to whom we are indebted for information on the breed, and who has rendered to its breeders services of the highest value. The first four volumes of the *Polled Herd-Book*, published by Dr Ramsay of Banff, included pedigrees of both Aberdeen-Angus and Galloway cattle. But in 1877 a Galloway Cattle Society was established which purchased the copyright of the Galloway portion of the *Polled Herd-Book* and published it as the first volume of the *Galloway Herd-Book*, twenty-eight volumes of which had been issued in 1908. About 20,000 females and one-half of that number of males have been registered in it.

Owing to a misunderstanding a substantial section of breeders in the north of England hived off from the parent society, and, joined by a number of breeders of pure-bred Galloway cattle, who had not registered their animals, formed a new organisation called the English Galloway Cattle Society. They had issued four volumes when, in 1908, negotiations took place between the two societies, which resulted in each of these being dissolved and a new body, called the Galloway Cattle Society of Great Britain and Ireland, being formed and registered under the Companies Acts. This new organisation includes in its membership breeders in all parts of the United Kingdom, and it bids fair to

conduce to the extension and prosperity of the breed.

Galloways have been exported in large numbers to North America, and in the *American Galloway Herd-Book* there have been registered at least as many of the breed as in the Herd-Book of Great Britain and Ireland.

Characteristics of Galloways.

Milking Properties. — It is not claimed for Galloway cows that in general they are deep milkers, although there have always been individuals which have been good at filling the pail. Their milk, however, ranks very high in respect of richness in butter-fat.

Galloway Beef.—It is as beef-producers that Galloway cattle are most highly esteemed. The quality of Galloway beef is exceptionally high. This fact has long been acknowledged, but it has been strikingly demonstrated in connection with the carcase competitions at the Smithfield Fat Stock Show. For years after these carcase classes were instituted the Galloways regularly, year by year, carried off the lion's share of the prizes against all other breeds. "The Druid," the well-known H. H. Dixon, author of the Royal Agricultural Society of England's Prize Essay on Shorthorns, published in 1865, says, "There is no better or finer mottled beef in the world than the Galloway and the Angus, and so the Smithfield prices show." Mr William M'Combie, the celebrated Aberdeen-Angus breeder, testifies that "there is no other breed worth more by the pound weight than a first-class Galloway."

A Natural Breed.—Galloways arrive at maturity at different ages, according to the way they are kept when young. They are essentially a natural breed, and have been kept as such, never having been pampered in any way. In the lowlands they come to maturity early, though it is not claimed for them that in an exceptional degree they are early maturers. In the uplands, where many of them are bred and reared, the climate is cold, the fare scanty, and little or no artificial food is given; the progress they make is, as might be expected, not rapid, although when Galloways so reared are taken to the lowlands they come away amazingly, after being put on more generous keep.

Weights.—Where there is so much diversity in the way they are kept and fed, only an approximation can be made of the average weight of Galloway cattle at different ages. The following may be taken as a fair estimate of the live- and dead-weights respectively of good well-fed cattle of this breed:—

Age.	Live-weight.	Dead-weight.
1 year 3 months, . .	900 lb.	540 lb.
2 years 3 months, .	1400 „	840 „

But far heavier weights are reached where the diet has been fairly generous all along, and where an effort has been made to force forward individual animals. At the Smithfield Fat Stock Show in 1883, a pure-bred Galloway steer, when 2 years 10 months 3 weeks old, weighed 19 cwt. 0 qrs. 20 lb.—that is, he turned the scales at 2148 lb. when 1055 days old, which makes an average daily increase of 2 lb. in live-weight.

At the Smithfield Show in 1908, a Galloway steer 1 year and 9 months old gave a live-weight of 11 cwt. 2 qrs. 18 lb., and a steer 2 years and 11 months old a live-weight of 15 cwt.

A Hornless Breed.—The Galloway has always been a hornless breed. If a member of the breed shows the slightest trace of a horn or even a scur, there is reason to suspect its purity. The prepotency of the breed is remarkable when crossed with other breeds, but in no respect so much so as in the matter of obliterating horns. Even when mated with the majestic horned West Highland variety of cattle, it is very rarely indeed that the produce has any trace of horns, and certainly it is no mean achievement to get quit of any trace of such horns as it were at one single stroke.

Hardiness.—With the exception of the shaggy picturesque West Highlander, the Galloway is admitted on all hands to be the most hardy among British breeds of cattle, and the difference between the two breeds in the possession of this characteristic is very slight, if it exist at all. This outstanding quality is highly prized, and is sedulously sought to be preserved. For this end the class of skin and coat is regarded as of no little importance. A moderately thick but mellow skin is preferred, and a typical Galloway should have two coats

of hair—an outer coat and an inner—the former moderately long, but soft and not curly, and the under coat should be thick, mossy, or woolly. It is the latter which is the more valuable in retaining the heat and keeping out the cold. The manner in which the cattle are reared conduces to their exceptional hardiness. The young ones generally pass the winter in the open air. The Druid says, "The sky and the hills of the glen are their only winter shelter, and however deep the snow may be they are kept out in the field." As the same authority puts it, "Unsheltered bullocks come to hand quicker in the spring than if they have the shed option." It is claimed for Galloways that, as a result of their being kept so much in the open air, they are in a special degree free from tuberculosis. A few years ago 80 were exported to the United States in one lot, and when the tuberculin test was applied to them by the Republic's veterinary inspector, every one of them passed the ordeal successfully.

Colour.—Until about a century ago there was much variety in the colour of Galloways. While the great majority were then black, some were brindled and dun, while a few were belted—that is, white round the middle, as if a white sheet had been fastened round them. During the last one hundred years almost all of them have been black—those of that colour being reckoned the most hardy. "Black and all black" is what is insisted on, but a very few belted and dun ones are still to be met with.

For Crossing.—Galloways have long enjoyed the highest reputation for crossing with other breeds. Their remarkable prepotency makes them valuable for this purpose, and while crosses bred from them are superior beef animals, they have the invaluable quality of hardiness to an extent which is a strong recommendation of them in this severe and variable climate. Pure Galloways have been crossed with Ayrshires, Herefords, and representatives of other breeds with success. In the south-west of Scotland Galloway bulls are mated extensively with Ayrshire cows in the dairy herds, and the produce are well thought of for the production of both beef and milk.

Blue-greys.

One of the most fashionable and highly prized class of beef cattle in this country is a first cross between the Galloway and the Shorthorn—these being widely and favourably known under the name of "blue-greys." They have that appearance in respect of colour from the coat having an almost equal admixture over the entire frame of black and white hairs. The districts where these are most extensively bred are the northern counties of England—especially Cumberland, Northumberland, and Westmoreland. They are larger in frame, come very early to maturity, and their beef is as choice as any put on the market. Some breeders mate the Shorthorn bull with the Galloway cow, while others follow the plan of using the Galloway bull and the Shorthorn cow. It is impossible to say which of these systems of mating produces the better animal.

The use of the Galloway cow is preferred by many on the well-founded ground that she can be kept decidedly more cheaply than the Shorthorn, and indeed the pure black female will thrive on poor land and in high altitudes where the more tender and dainty-feeding Shorthorn might experience difficulty in living. White Shorthorn bulls are chosen, preferably those of a white family, because they leave produce of more uniform colour than where the sire is a coloured Shorthorn. Blue-greys are almost invariably hornless in whatever way they are bred.

Many specimens of this cross have been prominent prize-takers at fat stock shows. In 1892 a steer out of a Galloway cow by a Shorthorn bull was supreme champion at Smithfield in the hands of Sir John Swinburne. At three years and five months old he weighed 2276 lb. In 1897 a steer by a Galloway bull out of a Shorthorn cow was champion at the same show after being champion at Norwich and Birmingham. At two years and ten months old he weighed 1800 lb. He was bred by Mr Parkin-Moore of Whitehall, Cumberland. In 1907 the champion at York Christmas Show, a blue-grey, turned the scales at 2310 lb., and was sold for £72.

Great auction sales of these "blue-greys" are held at Carlisle in the early

summer and autumn, as many as 3000 head of them being sold at the two auction marts on a single day at each season of the year. The estimation in which they are held may be judged by the fact that they often realise up to 5s. per cwt. live-weight more than animals of equal weight of any other pure or cross breeding. By far the largest number of blue-greys are first crosses. Galloway bulls have been successfully used in Ireland for producing blue-greys.

Points of the Breed.

The following statement of the points of a typical animal of the Galloway breed was drawn up by the Council of the Galloway Cattle Society of Great Britain and Ireland in 1883:—

Colour.—Black, with a brownish tinge.
Head.—Short and wide, with broad forehead and wide nostrils; without the slightest symptoms of horns or scurs.
Eye.—Large and prominent.
Ear.—Moderate in length and broad, pointing forwards and upwards, with fringe of long hairs.
Neck.—Moderate in length, clean, and filling well into the shoulders; the top in a line with the back in a female, and in a male naturally rising with age.
Body.—Deep, rounded, and symmetrical.
Shoulders.—Fine and straight, moderately wide above; coarse shoulder-points and sharp or high shoulders are objectionable.
Breast.—Full and deep.
Back and Rump.—Straight.
Ribs.—Deep and well sprung.
Loin and Sirloin.—Well filled.
Hook Bones.—Not prominent.
Hind Quarters.—Long, moderately wide, and well filled.
Flank.—Deep and full.
Thighs.—Broad, straight, and well let down to hock; rounded buttocks are very objectionable.
Legs.—Short and clean, with fine bone.
Tail.—Well set on, and moderately thick.
Skin.—Mellow, and moderately thick.
Hair.—Soft and wavy, with mossy undercoat; wiry or curly hair is very objectionable.

MANAGEMENT IN GALLOWAY HERDS.

For the most part the system of management pursued in herds of Galloway cattle is natural and simple. The cattle are so hardy that they spend a great deal of their time in the open fields, even throughout the winter months.

Chapelton Herd.

The following system prevails in the choice herd of Messrs Biggar & Sons, at Chapelton, Dalbeattie:—

Calves.—The calves are dropped as soon after 1st December as can be secured. Each calf is put to its dam three times a-day until grass time. Calves then go out to pasture with their dams, where they remain until September, when they are weaned. After being weaned the calves get a mixture of about 2 lb. of oats, maize-meal, and linseed-cake. This is increased later on. The calves are wintered out in fields.

Cows.—Cows lie outside until calving time. After calving they get roots and fodder—3 lb. of mixed oats, bran, and bean-meal, with chaff—until the grass comes. After the grass is sufficiently forward they get no artificial food.

The heifers are never in a house. In summer they have to depend on the pastures alone. In winter they get from 3 to 4 lb. of concentrated food, with a few roots and hay during the first year, and straw afterwards. Heifers are put to the bull at two years old.

Bulls.—Young bulls, after being weaned in September, are put on to clover-grass till about the 1st of November, getting 2 lb. per day of cakes and meals. After 1st November they are shifted on to old pasture, and the artificial food is gradually increased to 4 lb. per day, with, in addition, roots and a little hay.

The stock bulls run with the cows in summer. In winter they go out and in, getting cake, bruised oats, maize, and bran, with a liberal supply of roots and hay.

Messrs Biggar do not believe in pampering their cattle, and keep them out of doors as much as possible. They find that if they look after the young stock pretty well during the first year (after weaning), the animals can look after themselves thereafter. No yeld cow or heifer in the house ever gets any concentrated food.

Castlemilk Herd.

In Sir Robert Buchanan-Jardine's herd at Castlemilk calves are dropped from December to April. It is found, how-

ever, that those dropped in February and March generally do best.

Calves.—The cows are allowed to calve in a box, and the calf is left with the dam for a week. Afterwards the calves are taken from their dams and led out to suckle three times a-day. When the calves get "the cud" (at about three weeks or a month after birth) they receive a small quantity of hay with an allowance of pure linseed-cake. The cake is broken very small, and given in a trough immediately after the calf has finished sucking. This prevents them sucking each others' ears, &c.

Cows.—Cows that are extra good milkers suckle two calves. Cross-bred calves are got for this purpose, the cow's own calf being put on first to receive the largest share. In May the cross calves are weaned, and the cow and the pure-bred calf are turned out to pasture, and are allowed to run together until August.

When the cows go dry they are fed on straw and turnips. After calving they receive an allowance of ground oats, bean-meal, and bran, with roots and meadow-hay. As the cows suckle their calves there is no record of the yield of milk which they give. One, having lost her calf, was milked by hand, and gave 18 quarts daily. This, however, was exceptional, and cannot be taken as an average yield for the breed. Probably about 13 quarts may be set down as a fair average when the cows are in full milk.

Heifers.—Heifers after being weaned are kept all winter in a small field, with an open shed for shelter, and are fed with hay and turnips and a daily allowance of 2 lb. each of linseed-cake. During the second winter they lie outside with no shelter, and are fed on hay and turnips alone. Heifers are put to the bull at two years old.

Bulls.—Young bulls have the same treatment as heifers when suckling. During the first winter they are kept in field, with hedge or plantation shelter. The 2 lb. of cake allowed to the heifers is supplemented by from 2 to 4 lb. of meal (bean and Indian in equal parts). Young bulls are generally sold at from 12 to 15 months old. Any kept over this age receive the same treatment as stock bulls.

From the beginning of November, or a month before service is expected to begin, stock bulls are allowed about 4 lb. of bruised oats daily. After the season is finished they get grass during summer and straw and roots in winter.

Broomfield Herd.

In Mr F. N. M. Gourlay's herd at Broomfield, Moniaive, the undernoted system is followed:—

Calves.—The calves are dropped in January and February. All calves are suckled by their dams morning and evening until the grass comes, which is generally (in this neighbourhood) about the middle of May, when they are turned out with their dams. All calves get meadow-hay and about ¾ lb. of small linseed-cake daily. While in the byres the calves are taken to the cows on halters.

Heifer-calves when weaned are put on meadow stubble, or young grass if available, and given 1 lb. of linseed-cake. When grass fails they are put into a well-sheltered field and wintered there on good bog-hay, cut swedes, and linseed-cake. When grass comes the heifers run on the hill among the sheep until November, and are again wintered out on hay and roots. Heifers are put to the bull at two years old.

Bull-calves are treated in the same manner as heifer-calves until about the November term, when the allowance of concentrated food is gradually increased. Crushed oats, bran, and Indian meal mixed with cut hay, are given, in addition to linseed-cake, cut swedes, and bog-hay. Stock bulls run out in a quiet, well-sheltered field, and are given hay and roots in winter. No cake or meals of any description are given.

Cows.—The cows run along with their calves on hill-land from the middle of May until October, when the calves are weaned. The cows are housed at night about the middle of November, and run out in a rough field every day, except for a week after calving. Good meadow-hay and a few turnips are given, but no meals or cakes except in special circumstances.

Preparation of Animals for Shows.—Animals for exhibition are generously fed, great care being taken never to

surfeit. Special attention is paid to punctuality in feeding. All young stock are washed as often as may be necessary to keep the skin clean and the hair in good order, and are regularly haltered and led on these occasions. Cows are served before being turned out to grass with their calves, as if not settled before leaving the winter quarters they are very apt to miss the bull altogether.

Mr Gourlay keeps his Galloways on a sheep farm where he has good meadows, but practically no arable land.

A portrait of a handsome two-year-old Galloway bull is given in Plate 38, and a portrait of a typical Galloway cow in Plate 39.

RED POLLED CATTLE.

The Red Poll breed of cattle is native to East Anglia. The counties in which the breed was cradled are Norfolk and Suffolk.

Origin.—The cattle of this breed bear a close resemblance to the polled cattle of Scotland, and from the fact that in former times Scottish cattle were in large numbers transported to Norfolk for fattening, it is assumed that this likeness in form arises in some part from kinship in blood. Be this as it may, the Red Polled breed can be traced as a distinct and well-defined variety far back into the eighteenth century. In his *Review of Norfolk*, published in 1782, Marshall states that the native cattle of the county were "a small hardy thriving race, fattening as freely at 3 years old as cattle in general do at 4 or 5. They are small-boned, short-legged, round-barrelled, well-loined, the favourite colour a blood-red, with a white and mottled face."

Writing twelve years later, Arthur Young says the Suffolk breed of cattle "is universally polled—that is, without horns; the size small, few rise when fattened to above 50 stones (14 lb.); the milk-veins remarkably large; cows upon good land give a great quantity of rich milk."

The Improved Red Poll.

The improvement of this breed may be said to date from the year 1846, when the Norfolk and Suffolk types became merged. In that year the East Norfolk Agricultural Association established separate classes for Norfolk Polled cattle. Descendants of the winning animals at that show, exhibited by Mr G. B. George of Eaton and Mr T. Edwards of Hatton, were registered in the first volume of the *Red Polled Herd-Book* in 1874. The amalgamation of the Eastern and Western Division Societies in Norfolk and Suffolk gave a strong impetus to the improvement of Red Polled stock. Then in 1847 Mr T. Crisp of Butley Abbey, Suffolk, won at the Norfolk Show with his two bulls. The struggle between the two counties continued with varying success.

In 1868 the late Mr Clare Sewell Read, M.P., before the British Association at Norwich, declared that "as a set-off against the loss of the Devons we have to commemorate a grand revival of the Polled Norfolks as a numerous and distinct breed; . . . horns and slugs are studiously avoided, and milking properties well cared for. They possess a uniformity of character, style, and make that would do credit to many of our established herds."

In July 1862, Mr Ellis at an agricultural meeting declared that "there is much in your native breed which is deserving of your notice, and which your forefathers knew was valuable. . . . I have never heard in Norfolk of the existence of a herd-book of stock; . . . there is a great deal in a herd-book. . . . I can only express my astonishment that as you have animals of such a class and of so good a stock you have not done more."

Establishing a Herd-Book.—Eleven years after Mr Ellis urged the establishment of a herd-book, a meeting was held at Norwich and a Society formed. The late Mr C. S. Read was president. It is

a fact worthy of note that those responsible for the Herd-Book instituted the system of recording tribes. Thus the "A" group consisted of Elmham stock. Here the cows known to be of the old Elmham stock were registered; secondly, the cows for a long period in the possession of the tenantry; and, thirdly, recent additions. Tribes were thus associated with groups, and the system is still in operation.

Standard Description.

What is a Red Poll? The answer to this question was settled when the Herd-Book was instituted. The standard description is as follows:—

ESSENTIALS.

Colour.—Red. The tip of the tail and the udder may be white. The extension of the white of the udder a few inches along the inside of the flank, or a small white spot or mark on the under part of the belly by the milk-veins, shall not be held to disqualify an animal whose sire and dam form part of an established herd of the breed or answer all the other essentials.

Form.—There should be no horns, slugs, or abortive horns.

POINTS OF A SUPERIOR ANIMAL.

Colour.—A deep red, with udder of the same colour, but the tip of the tail may be white. Nose not dark or cloudy.

Form.—A neat head and throat. A full eye. A tuft or crest of hair should hang over the forehead. The frontal bones should begin to contract a little above the eyes, and should terminate in a comparatively narrow prominence at the summit of the head.

This interesting description has the merit of brevity and terseness. But that, in one sense, may be regarded as its weakness. It may be advisable, therefore, to supplement it with a pen-picture of a modern Red Poll.

The Modern Types.—It is necessary to refer in the plural to the types of Red Poll. A breed which has won its way largely by reason of its milking qualities must necessarily be also a good feeder if it is to find support amongst East Anglian farmers. As might be expected, the Norfolk—or larger type of Poll—is the class of animal we find in the open courts laying on flesh for Christmas markets. Norfolk is the paradise of the feeder, there being a virtue in Norfolk roots unequalled by the produce of any other county out of Scotland. So much so, indeed, is this the case that animals can grow fat on roots and hay.

The larger type of Red Poll is usually the showyard favourite. It is hardly necessary to remark that when a milking type meets a beef-producing type in the show-ring the odds are in favour of flesh. A big, well-grown, level-fleshed animal is the Norfolk Poll. Occasionally we find a lack of sweetness in the females, but a typical Norfolk cow may be thus described: A neat head with a befringed poll, which distinguishes it from the Aberdeen-Angus type, is well set on a clean-cut neck. The eye is prominent but not bold. The muzzle broad and free from specks. The shoulders should be well laid, and not pointed. The dewlap is square, but the width of breeds such as the Shorthorn is absent. The ribs spring well from the back, and carry a good covering of flesh, a large proportion of lean to fat. The back is level, the pin-hooks are smoothed over with flesh in the male, but prominent in the female. The tail should be moderately thick, and fall at right angles to the back. The hind quarters are not square, but slightly rounded. The underline is lengthy, and fills the hand at the flanks. The vessel in the cow is not exceptionally capacious in appearance, but the teats are well placed and large.

In the milking or Suffolk type there is less flesh, smaller stature, and a larger vessel.

Colour.—The colour should be an attractive red not too dark, without suspicion of yellow, and not too bright. The yellow shade is very insidious, and hard to breed out. It is frequently accompanied by white markings, which are a distinct objection. It is an old fancy, probably founded on fable, that cows of a yellow shade are specially good milkers. The truth of the statement is not borne out by observation.

Red Polls in the Showyard.—The showyard has a tendency to run a dual purpose breed to flesh. This tendency is sometimes observed in the Red Poll. There can be no doubt that the fattening qualities have been greatly improved, but the primary aim of a Red Poll is to produce milk. That, at all events, is the

chief reason why the breed has found a home in counties far removed from those of its birth.

Locality.—The breed flourishes in Norfolk and Suffolk. There are also herds in Essex and the neighbouring county of Herts. In Shropshire there is one very thriving herd, while in far-away Ireland there is a colony of admirers. The foundation of the Irish demand was laid about the middle of the nineteenth century. Lord Dartrey was one of the pioneer importers into Co. Monaghan as far back as 1861. Animals have also been sent into Wales, and there is a considerable export trade to North and South America.

Weights.—The breed has for many years been classified at Smithfield and East Anglian fat stock shows. As indicative of the weights to which good bullocks will grow, it may be stated that a prize steer, aged 1 year 11 months 2 weeks, scaled alive 12 cwt. 1 qr. 16 lb., which would be a very good average for prize fat stock. A two-year-old steer in 1908 reached a live-weight of 16 cwt. 2 qrs. 23 lb. at 2 years 10½ months old,—rather a greater weight than the average, which may be stated at about 1 cwt. less.

Milk Yields.

Illustrative of the excellent milk-yielding capacity of the Red Poll, reference may be made to the very complete records which are kept in Lord Rothschild's herd at Tring Park. In 1907 there were 40 cows in the herd throughout the whole year. These produced a total of 262,859 lb. of milk, averaging 6571½ lb. per cow. The highest individual yield was obtained from "Clarissa," whose 12,005 lb. was spread over 303 days, making the very high average of 39.61 lb. daily while in lactation. The best yield of the first-calf cows drafted into the herd was obtained from "Parody," calved on March 5, 1904. She gave 7150 lb. in 332 days,—a remarkably good result for a three-year-old.

In the Hon. A. E. Fellowes' herd at Honingham, near Norwich, the average for twelve cows and heifers, averaging 284 days in milk, was 6300 lb., one cow giving 11,833 lb. in 329 days.

The average milk yields recorded in Sir Walter O. Corbet's small herd at Acton Reynold, near Shrewsbury, are as follows:—

Year.	Number of cows.	Average yield in lb.
1903	9	6434·33
1904	9	7236·72
1905	12	7753·45
1906	8	8073·75
1907	9	7363·77

MANAGEMENT OF RED POLLS.

Feeding occupies a prominent place in the management of a Red Polled herd of dairy cattle. Each owner has his own method.

Eldo House Herd.

Mr A. H. Cobbald of Eldo House, Bury St Edmunds, who has kept upwards of sixty cows for several years, has tried numerous rations with varying results. He believes in the cheapest kind of corn ground into fine meal, allowing from one to two gallons daily, with chaffed hay and straw mixed, and about half a bushel of pulped mangels. A shredder, preferably to a mincer or pulper, is used in preparing the food. In addition to this, the cows get about 10 lb. each daily of long hay in racks over their mangers, and an iron pan filled with clean water is provided between two cows.

Cows.—From 1st May to 1st November the cows lie out in the open, and grass is the chief food. Only about half a gallon of meal mixed with chaffed hay is given daily while they are being milked. From 1st November to 1st May the cows are tied up in a shed, with stalls about 7 feet wide to hold two cows. The cows are turned out for exercise every day except on very cold wet days. During these months their food is increased to the rations first mentioned.

The Honingham Herd.

In the herd of the Hon. A. E. Fellowes, the cows are turned out to pasture in the ordinary course in the summer months. They have lucerne in the open

yards when they come up to be milked. During the winter months they are turned out upon pastures daily for some time to exercise, no matter how cold. If wet, or snow is on the ground, they go out for a little time. The remainder of the time they are kept in partially covered yards made of corrugated iron. Their food chiefly consists of chopped oat-straw and hay mixed, with a little long hay. At milking they have one bushel of kohl-rabi, with bran and oats, and a small quantity of cake daily when in full milk.

Calves.—The calves are taken off the cows when a week old and placed in calf pens. They are then fed on new and separated milk to which linseed and oatmeal are added. When old enough they get crushed oats, bran, linseed, and cake in small quantities. In particular cases the calves are kept upon the cows for some weeks to bring them up fit for exhibition. When the calves are able to take their food freely they are turned into open yards during winter and summer, it not being the custom to turn them out to pasture until they are from ten to twelve months old. Calves are not allowed to remain out in damp, cold nights, nor in the heat of the day if the flies are troublesome. At the same time they receive hay, lucerne, and artificial food.

Heifers.—The heifers are not put into service at Honingham until they are about a year and ten months old. They are generally allowed some time before being put to service after the first calf, as otherwise they would not develop sufficiently.

The steers are readily bought by butchers, who give 6d. more per stone for them than for other local breeds. Their weights as dressed carcases are surprising, having little offal. They can be kept in courts without danger, as they are peaceable feeders.

Acton Reynold Herd.

In Sir Walter Corbet's herd at Acton Reynold, near Shrewsbury, the plan of putting two calves on a foster mother is adopted. Mr Reginald Astley, the agent, says: "The foster mothers generally cost about £14 or £15. After the calf that is on them when bought has been sold, they are always sent to some bull in the neighbourhood, and they sell very well when they calve." The ordinary cows in the Acton Reynold herd calve in January, February, or March.

Young Stock. — In the following September the training and education of the young show stock commences. Only the best bull-calves are kept, the others being made into steers and fed. The heifers not intended for exhibition are kept in roomy yards where they get exercise, and are fed on hay *ad lib.*, two feeds of roots, and about 1½ lb. to 2 lb. of cake and meal daily. In summer they are turned out to pasture, remaining there the following winter, and getting from 3 to 4 lb. of cake and meal daily, three feeds of roots, and hay *ad lib.*

The heifers go to the bull at from sixteen to eighteen months old, but the exhibition heifers go to the bull in November or December, so that they may not be too heavy in calf when exhibited. Mr Astley says: "It is most important that all heifers should be got in calf before being exhibited as two-year-olds, as otherwise there is a very great probability that after being fed up, which is absolutely necessary if they are to have a proper chance of winning, they will not hold to the bull and be ruined for breeding purposes."

Combination of Beef and Milk.—With regard to the combination of beef and milk, an instance is furnished by an Acton Reynold cow, which averaged for six years 10,039 lb. of milk, and was the dam of two Smithfield Breed cup winners, the weights and ages of which were—

Heifer, 2 years 5 months 27 days; 16 cwt. 2 qrs. 14 lb.
Steer, 2 years 5 months 9 days; 15 cwt. 3 qrs. 18 lb.

Mr Astley believes that Red Polled cattle will, better than any other breed, fulfil the condition of producing both milk and beef in the same animal.

A portrait of a noted Red Polled cow is given in Plate 34.

SHORTHORN CATTLE.

It is acknowledged by all that the Shorthorn has abundantly earned the right to the premier position amongst British breeds of cattle. It is by far the most numerous, as it is the most widely diffused. . More wealth is bound up in it than in any other variety of the bovine race. In the development of the live-stock industry of the United Kingdom it has played a great part, far exceeding that of any other distinct class of animals. And the breed has done more than develop wealth at home. It has gone in vast numbers to foreign countries, bringing in exchange foreign gold to British farmers, and creating wealth, and promoting agricultural prosperity wherever it has been given a habitation. The breed which has done all this—and is as busy at work as ever, widening its field of operations from time to time—well merits a word of homage from the live-stock historian.

Origin of the Breed. — Extremely little is known of the foundation elements of the Shorthorn breed, and next to nothing of the moulding influences exerted by breeders during the seventeenth century. Even for the period between 1700 and 1750 there does not exist much of a practically useful character in the form of breeding records. The breed was probably in more or less complete possession of Durham and North Yorkshire for two or three hundred years before it began to attract the attention of outsiders. Some writers have associated the early history of the breed with Holland, but there is now a general agreement that it is not of Dutch origin. Further, it is fairly well established that the occasional importations of Dutch stock referred to by Culley, William Ellis, and others, had comparatively little influence on the Durham or Teeswater breed during the first forty or fifty years of the seventeenth century. Later alloys of Galloway and Highland blood were rather incidentals than disturbers of the breed's course. The main elements were powerful enough to assimilate such factors without betraying outward signs of the blending.

Mr James Cameron, to whom we are indebted for information regarding the breed, states that in the early decades of the seventeenth century the Teeswater cattle were mostly large-framed, yellowish-red, red-and-white, and white stock, odd specimens being of a "mealy-roan" hue. Old Northumberland traditions also had it that numbers of the cattle showed dark noses and patches of blue on the skin, such markings being no doubt due to previous crossings with the native black cattle of surrounding districts. Persistence of "unfashionable" noses and a dull blue slatey-roan may thus be accounted for, but to what extent the occasional blue or blackish tips in horns are due to very old out-crosses it is impossible to say.

With reference to the blood-red colour which is now so much prized, there is no evidence to show that it was common in the early part of last century. It is to all intents a relatively modern evolution, the result of careful and persistent selection.

Early Improvers.

Among Shorthorn improvers of the earlier part of the eighteenth century, high positions must be given to Smithson of Stanwick; the brothers George and Matthew Culley of Winton; John Maynard of Eryholme; Waistell of Great Burdon; John Hunter of Hurworth—breeder of the remarkable bull "Hubback" 319; Stephenson of Ketton; John Charge of Newton Morrell, well known as a friend of Bakewell; Jolly of Worsall; and Michael Jackson, who bred the sire of Maynard's cow, "Favourite." Those men, and large numbers of their contemporaries, were of untold benefit to the Shorthorn interest. They prepared admirable materials for the great breeders, the brothers Charles Colling of Ketton (1750-1836) and Robert Colling of Barmpton (1749-1820), both frank admirers of Bakewell, and ready appreciators of his selective and mould-

ing methods,—Charles having, indeed, lived with Bakewell as a pupil.

The Brothers Colling. — With intuitive knowledge of animals while such were still "in the making," the brothers Colling purchased all round their own neighbourhood, and then proceeded to fix their ideal type by means of in-breeding. They were, at the same time, judicious advertisers of their own cattle. The "Durham Ox" of the one and the "White Heifer" of the other—both by "Favourite" 252—turned the attention of a larger public to the merits of the improved Shorthorn. In short course, the Collings had high prices for bulls and cows. On the wonderful cattle bred by the brothers or owned by them, the best being full of "Hubback" blood, there is no need to dilate here. The bull "Foljambe" 263, grandson of "Hubback" and sire of "Phœnix"; "Old Cherry," "Old Daisy," "Duchess" by "Favourite," and dam of Bates' "Duchess 1st"; "Red Rose," "Favourite," or "Lady Maynard," the 216 guineas "Lady," and many others, are easily called to remembrance by students of Shorthorn history.

Charles Colling's sale at Ketton in 1810 was the first great event of its order. At that disposal 29 cows and heifers averaged £140, 4s. 7d., while 18 bulls reached an average of £169, 8s. The marvel of the time was the sale of the light roan bull "Comet" 155, at 1000 guineas, to Messrs Wetherell, Trotter, Wright, & Charge. Eight years later Robert Colling had the astonishing average of £128, 9s. 10d. at Barmpton for 61 head, although agriculture was then in a depressed condition. Looking back, it is practically impossible for any student of Shorthorn affairs to over-estimate the importance of the work done by the brothers Colling.

Among the many gifted men who took up Shorthorn breeding at the end of the eighteenth or beginning of the nineteenth century were Christopher Mason of Chilton, Robertson of Ladykirk, Thomas Booth of Killerby and Warlaby, and Thomas Bates, whose name will always be associated with Kirklevington, which he purchased in 1811. For his foundation materials Mason went to Maynard and Charles Colling. On the male side he relied upon Colling bulls, and so great was his success as a breeder that the Booth family and Thomas Bates, while at the opening of what proved to be lifelong forms of animosity, agreed that Mason had blood to suit the two "rival houses."

Captain Barclay's Pioneer Work. —In the north of Scotland the pioneer breeder of Shorthorns was that remarkable man, Captain Barclay of Ury, who at the dispersion of the Chilton herd in 1829 acquired the grand three-year-old cow "Lady Sarah" for 150 guineas. She was then said to be in calf to Mason's "Monarch" 2324, and at Ury she produced a bull-calf, which was named "Barclay's Monarch" 4495. She bred, further, the notable "Mahomed" 6170, "Pedestrian" 7321, and "Sovereign" 7539, and the females "Julia," "Cicely," and "Helen."

Booth Cattle. — Reverting to the Booth family, the steadfastness of purpose shown by that race of breeders for well over a hundred years is probably without parallel in the whole world of stock-breeding. Thomas Booth and his two sons, John and Richard Booth, were of one mind in regard to type, but the remarkable matter is that their tastes should hold such overpowering dominance over strong minds of the third generation. The Booths fixed on a type which in the main showed a pronounced tendency towards beef-production. Milking powers were cultivated to a reasonably full extent, and when capabilities at the pail came easily and naturally they were always welcomed. Still, the beef-carrying carcase was the family ideal.

In the time of John and Richard Booth it was wont to be said that the Warlaby, Killerby, and Studley cattle lacked gaiety and style. The representative bulls had frequently round, strong, forward-staring or slightly high-set horns, big curly heads, wide crops, very deep fore-quarters, arching ribs, and usually fairly long and deep hind-quarters, but they did not walk with the easy dash of animals showing something of the "racehorse shoulders" and less compact knitting of frame. To a very great extent the old criticism on the Booth cattle retained force until the end of the nineteenth century.

Bates Cattle.—Bates, with his more artistic nature, was captivated by style, while, on the practical side, his leanings were strongly towards milking powers. He was a great admirer of a beautiful head. His bulls, with their flat and generally well-set horns, broad foreheads, large staring eyes, nicely chiselled faces, expansive nostrils, long, clean, arching necks, high and rather narrow shoulders, and general length and "liberty" of frames, cut a dash while on parade. Opponents of the Bates' cult were not loth, as a rule, to note such defects as bare shoulder-blades and flat fore-ribs, nor did they hesitate at times, even during the life of the old man of Kirklevington, to hint that constitutions were in danger, and that milk was departing from one or two ultra-fashionable families.

The Booth and Bates' partisanships lasted for well over thirty years, and during the period of faction the Shorthorn breed lost many friends in the English tenant-farmer ranks. A complete break-down of the unfortunate petty divisions did not come until the early 'eighties of the past century. Before that time Lord Dunmore had two great sales and fortunate "escapes" with cattle, mainly of Kirklevington descent —first in 1875, when 30 cows and heifers averaged £576, 5s. 6d., and 9 bulls and bull-calves £992, 16s. 8d.; and, finally, in 1879, when 54 head realised £13,118, 14s., an average of £241, 14s. 3d. The sensation of the 1875 sale was the disposal of the two-year-old bull "Duke of Connaught" 33,604 to Lord Fitzhardinge at 4500 guineas. At the 1879 sale, "Duchess 114th," her yearling daughter, and her bull-calf, "Second Duke of Cornwall," made a total of £7507, 10s. "Duchess 117th" and "Duchess 114th" passed to Sir Henry Alsopp at 3200 guineas and 2700 guineas respectively.

Later Improvers.

While the Booth and Bates' fashions were running their course, work of great excellence on behalf of the Shorthorn was overtaken in England by such men as Sir Charles Knightley, Colonel Towneley, and Wilkinson of Lenton; in Ireland by W. T. Talbot Crosbie and others; and in Scotland by Captain Barclay—who never really experienced the bitterness of the contentions—and after him by Amos Cruickshank, Sittyton; Wm. Hay, Shethin; Sylvester Campbell, Kinellar; Wm. S. Marr, Uppermill; the Duthies, and others.

Cruickshank Shorthorns. — Amos Cruickshank, to whose memory world-wide homage is now paid, purchased his first heifer in Durham. That was in 1837. In the following year he went south to Nottingham, and returned home with about a dozen heifers. From that stage onwards for many years he and his brother Anthony were constantly on the outlook for good animals at reasonable prices. The first sires used were of Ury blood, and these were followed for about a quarter of a century by bulls of high repute from many herds, such as those of Torr, Wiley, Richard Chaloner, Colonel Towneley, Smith of West Rasen, Wilkinson of Lenton, Foljambe, Pawlett, Willis, Sir William Stirling Maxwell, and the Duke of Montrose. Looking backwards, the existing race of breeders are struck by the apparent want of system in the Sittyton selections. One is forced to the conclusion, however, that Amos Cruickshank was never really able during those years to reach his ideal. Booth blood preponderated in the sires which he selected, but his search was for a good animal. He paid little regard to pedigree.

A turning-point in the history of the Sittyton herd was reached at the fall of 1858. Cruickshank was in need of a young red bull for use during the following spring. He applied to Wilkinson of Lenton, and was strongly recommended to take "Lancaster Comet" 11,663, a fleshy short-legged roan over eight years old, and in-bred to the remarkably prepotent sire "Will Honeycomb." This "Comet" was not liked by some of Cruickshank's neighbours, on account of his long "Highland-looking" horns. After limited use, he left about a dozen calves, two of these being "Champion of England" 17,526, which was used in the herd for nearly twelve seasons, and "Moonshade" 18,419, which passed into the Inverquhomery herd. When the merits of "Champion of England" as a sire were clearly seen, his blood was gradually worked through the whole

stock by means of sons, grandsons, and other descendants. This concentration of blood gave the Sittyton cattle great uniformity of character and singular impressiveness.

In the year 1889, when Amos Cruickshank was in his eighty-second year, the whole herd was purchased by Mr Robert Bruce for Messrs James Nelson & Sons, the aim being exportation to the Argentine. The great South American country, however, was then passing through financial trouble, and most of the cattle had to be disposed of privately in this country. Mr William Duthie, Collynie, and Mr J. Deane Willis, Bapton Manor, fortunately for the interests of the breed in general, secured a large number of the best animals.

Cruickshank Cattle in England.—In the 'seventies and 'eighties of the past century Amos Cruickshank had excellent customers for his best bulls and spare heifers in North America, but the prejudice against his cattle was still strong in England. The hiring of the Sittyton-bred "Field-Marshal" in 1884 for the Windsor herd was considered a rash step. From about 1890, however, a gradual change in favour of the Sittyton type began to set in all over the United Kingdom. South America also began to patronise Cruickshank cattle strongly, and since that time stock of Sittyton descent have gone everywhere in pure form, and have blended admirably with Booth, Bates, Knightley, and other strains. Many of the finest cattle to be seen in the English showyards of the present day are of Booth, Bates, or other old southern descent, with two or three Cruickshank top crosses. History is prone to repeat itself. The existing danger is that good cattle may be neglected because they are not quite in the fashion.

The Ideal Shorthorn.

The type of perfection in Shorthorns, as in other stock, has varied slightly from time to time. There is now a tendency towards the breeding of a rather smaller and more closely-knit Shorthorn than was common prior to the closing decade of the past century. In the main, also, the beefy type wins most prizes at the open shows, but sensible attention is paid to milking properties in heifers and cows.

In the ideal Shorthorn bull of to-day the horns should be flattish, with a wide space between the roots, rich in colour, and free from black or blue at the tips; the forehead should be broad, the eyes prominent and gentle, with expressive chiselling under them; the length from eyes to nostrils should be moderately short, and the nose should be perfectly free from black spots or even faint bluish stains. Free from throatiness, yet robust looking and with a fair crest, the neck should taper gradually into fairly wide well-covered shoulders and crops, and the brisket should perfectly fill the space between the fore legs. A broad chine or back, arching ribs, great heart girth, strong well-covered loins, neatly turned hooks or hips, long, smooth, and deep quarters, squarely set-on tail, straight hind legs, flat bone, mellow hide well clad with mossy hair, and jaunty easy carriage complete the picture.

In a female, more refinement of face, neck, and shoulders are of course looked for, and the hips are more on the square, but still they ought not to be unduly prominent. Some representative Cruickshank bulls were rather plain in horn, and although they had grandly covered backs, their quarters were relatively short or wanting in finished appearance. Their thick shoulders and general compactness of build were also to some extent against liberty of movement.

In most parts of the United Kingdom fairly strong efforts have been put forth to breed out light "washy" roans and gaudy reds-and-whites, because the exporting demand has been much set on rich roans and blood-reds. Representative herds are consequently a good deal darker in colour than they were a quarter of a century ago. In practice it is found advisable to make occasional use of white bulls for the purpose of preserving a balance of mellow roans.

Mr John Thornton's Ideal Shorthorn.—The typical characteristics of the breed were thus described by the late Mr John Thornton, the celebrated Shorthorn auctioneer:[1] "The breed is distinguished

[1] *Cattle, Sheep, and Pigs of Great Britain.* By John Coleman. Horace Cox, *Field* Office, Breams Buildings, London.

by its symmetrical proportions and by its great bulk on a comparatively small frame; the offal being very light and the limbs small and fine. The head is expressive, being rather broad across the forehead, tapering gracefully below the eyes to an open nostril and fine flesh-coloured muzzle. The eyes are bright, prominent, and of a particularly placid, sweet expression; the countenance being remarkably gentle. The horns (whence comes the name) are, by comparison with other breeds, unusually short. They spring well from the head with a graceful downward curl, and are of a creamy white or yellowish colour; the ears being fine, erect, and hairy. The neck should be moderately thick (muscular in the male), and set straight and well into the shoulders. These, when viewed in front, are wide, showing thickness through the heart; the breast coming well forward, and the fore legs standing short and wide apart. The back, among the higher-bred animals, is remarkably broad and flat; the ribs, barrel like, spring well out of it, and with little space between them and the hip-bones, which should be well covered with flesh. The hind quarters are long and well filled in, the tail being set square upon them; the thighs meet low down, forming the full and deep twist; the flank should be deep so as partially to cover the udder, which should be not too large, but placed forward, the teats being well formed and square set, and of a medium size; the hind legs should be very short, and stand wide and quite straight to the ground. The general appearance should show even outlines. The whole body is well covered with long, soft hair, there frequently being a fine undercoat; and this hair is of the most pleasing variety of colour, from a soft, creamy white, to a full, deep red. Occasionally the animal is red and white, the white being found principally on the forehead, underneath the belly, and a few spots on the hind quarters and legs; in another group the body is nearly white, with the neck and head partially covered with roan; whilst in a third type the entire body is most beautifully variegated, of a rich, deep purple or plum-coloured hue. On touching the beef points, the skin is found to be soft and mellow, as if lying on a soft cushion. In animals thin in condition a kind of inner skin is felt, which is the 'quality' or 'handling,' indicative of the great fattening propensities for which the breed is famous."

Attributes of the Breed.

Enough has already been said to indicate that the Shorthorn can claim attributes of the very highest order. It is universally acknowledged that in the production of beef and in general utility combined the Shorthorn is unsurpassed. It may be excelled by some other varieties in special aptitude for peculiar purposes or for certain limited districts; but for a combination of all the more useful properties of domestic cattle, as well as adaptability to varying conditions of soil, climate, and treatment, there is no other breed of cattle that can equal the Shorthorn.

Beef-Production.

It was perhaps most largely by its remarkable beef-producing properties that the Shorthorn gained its early fame. "From the very outset the improved Shorthorn took up a position of pre-eminence as a beef-producer, which it has ever since maintained. Its fame was won by its rapid feeding properties at a time when there was a keen struggle between various breeds to supply an improved type that would meet the growing requirements of the public. No doubt, at first size was the main consideration, though in sending round the country the 'Durham Ox' and 'The White Heifer that Travelled,' the object of the Collings was to arrest attention to these as specimens of what the breed was capable of accomplishing, rather than as the sort of animals which they wished farmers to keep and breed. Shorthorns of less imposing size and fatness were more suitable for ordinary purposes, but for years before and after the Collings the various breeds were recommended by the abnormal specimens they could produce. Very soon quickness of growth and ripening, reduction of waste, and finer bones and choicer quality were required, and the Shorthorns were found not only to supply these requisites themselves, but to stamp them on the inferior races with

which they were crossed. In converting the herbage of the farm into wholesome nutritious food for the increasing population of the country the Shorthorn was unsurpassed, and when to this was added the good milking properties of the cows, which soon made up when dry into a thoroughly good carcass of beef, the claims of the breed received wide recognition."[1]

In the annals of the breed there are instances of great weights attained by individual animals. A twin heifer slaughtered at three years of age weighed in carcase 980 lb. A three-year-old ox, slaughtered off the pasture, yielded a dead-weight of 1330 lb. Many cows give from 1000 to 1200 lb. of carcase. For two-year-old Shorthorn steers dead-weights of from over 800 lb. are now by no means rare. It has become quite common to fatten off steers of the breed at from eighteen to twenty months old, and by that age they attain wonderful weights and show well-matured carcases.

The live-weights recorded in the shows of the Smithfield Club are worthy of note. Average live-weights for Shorthorns there are—steers under two years old, 1400 lb.; steers over two and under three years old, 1830 lb.; oxen over three years, 2250 lb.; heifers under three years, 1730 lb.; and cows over three years old, 1900 lb. The average daily gain in live-weight for Shorthorn steers under two years at the Smithfield Show has been about 1.93 lb., for steers over two and under three years 1.67 lb., and for heifers under three years 1.58 lb. At the Smithfield Show of 1908 twelve Shorthorn steers, whose average age was 22½ months, gave an average live-weight of 12 cwt. 2 qrs. 14 lb., the lightest being 10½ cwt. and the heaviest 14 cwt. 19 lb.

Shorthorns have taken creditable positions in the competitions at the Smithfield Show for carcases. An animal of the breed has yielded no less than 73.75 per cent of live-weight in carcase.

For Crossing Purposes.

Another outstanding attribute of the Shorthorn is its unequalled value for crossing purposes. "No variety of cattle fits itself more easily and readily to varying conditions of life than the improved Shorthorn. This undoubtedly is one of the most valuable attributes of the breed. Without it Shorthorns would have made but little headway in foreign countries, where they are now doing good work. In both Scotland and Ireland they have thriven admirably,—nearly as well, indeed, in the cold dry climate of the north-east of Scotland, with close house winter feeding, as in the mild, moist climate of the south of Ireland, with daily field exercise all the year round. In both countries there are numerous pure-bred herds of high individual merit, a few of them ranking among the finest in the kingdom. The Aberdeenshire Shorthorn has attained a well-recognised type—somewhat deficient in high-class Shorthorn character perhaps, but, at the same time, broad, deep, well-fleshed, and thoroughly useful. Then as to well-bred and well-cared-for Irish Shorthorns, who has not been struck by their rich, soft, natural touch and beautiful, rank, glossy coats of hair, as well as by their attractive character generally?

"But while the breed reared in its purity has maintained a high character in these countries, it cannot be doubted that in crossing with other varieties of cattle it has achieved still more remarkable results. Shorthorns have been crossed freely with all the local races and sorts of cattle, and have everywhere and upon every sort effected marked improvement. In all that adds value to cattle, improvement has followed in the wake of the Shorthorn—in size, form, quality, rapidity of growth, and aptitude to fatten at an early age. Among the small, scraggy, old-fashioned Irish cows, Shorthorn bulls have produced results truly wonderful. Stock from an ordinary Irish cow and a good Shorthorn bull will, it is estimated, reach maturity at least a year sooner than unimproved cattle—at two and a half or three, instead of from three and a half to four years old. Moreover, the cross, besides being far superior in quality, will also show an increase in weight of from 1 to 1½ cwt. per head. It is certainly within the mark to place the

[1] *History of Shorthorn Cattle.* Edited by James Sinclair. Vinton & Co., Limited.

increase in the value of one-year-old Irish cattle due to the use of Shorthorn bulls at from £2 to £3 a-head on an average. In many instances it has risen as high as £5, and in few cases has it failed to reach £2—that is, above the value of the corresponding class got by native or cross-bred bulls.

"In Scotland the experience of the breed has been equally satisfactory. The stock of native cows in Scotland are, as a rule, larger and finer than those of Ireland, and therefore the contrast between the native cattle and the improved crosses has generally been less marked in the former country than in the latter. In some parts of Scotland, however, where the native cattle were small and slow in growth, the transformation effected by Shorthorn bulls has been quite as remarkable as in Ireland."[1]

Milking Properties.

The milking properties of the Shorthorn are of a high order. Sure evidence of this is found in the great predominance of Shorthorn features in cross-bred dairy herds throughout the country. In many of the pure-bred herds large yields of milk are recorded, and this too from cows which produce fattening stock of the highest merit. "The late Mr E. C. Tisdall, of the Holland Park Dairy, Kensington, who long cultivated a Shorthorn dairy herd, reported, among the records of many years' experience, an average of 885 gallons apiece yielded by twenty-five cows of this breed during the ten or eleven months of the year when they were in milk, and ten selected cows had yielded as much as 1200 gallons apiece in the same time. The yield of butter by the Shorthorns has been exceeded by other breeds, but the returns of milk and butter together have not. There is a record of a cow having produced 1650 gallons of milk between May 20, 1888, and April 7, 1889, which is, of course, an exceptional quantity. The cows in the Duke of Westminster's dairy herd gave an average yield, in 1890, of 714 gallons each. Others report yields over the whole herd of 885 gallons, and single cows have given 1050 gallons annually for several consecutive years. At the London Dairy Show, for ten years the milk produced by Shorthorns averaged 43.13 lb. per day, and the total solids showed a percentage of 12.87, of which 3.73 was fat, and 9.14 other solids. Taking a later period of five years the averages are—age 6 years and 1 month, days in milk 42.8, daily milk yields 49.2 lb., fat 3.91 per cent, solids other than fat 9.08 per cent, total solids 12.99 per cent. The breed standard of the British Dairy Farmers' Association for Shorthorns is 8500 lb. of milk, and pure butter fat per diem 1.25 lb.; and with respect to other fat, the Shorthorn has the same weight assigned as the Jersey and Guernsey, the Dutch being put at 1.00 lb.

"In recent years, careful records have been kept of the milk yields in a number of Shorthorn herds. Lord Rothschild's herd, at Tring Park, is a noteworthy example, the statistics being published annually by Mr Richardson Carr, the agent. Several cows in the herd have records of over 10,000 lb. of milk per annum. The average yield in a herd of thirty-eight cows for the year ending September 30, 1905, was 7031 lb. per annum. 'Decentia 24th,' 371 days in milk, gave 10,069 lb. For fifty-seven cows in the year ending September 29, 1906, the average was 6706 lb. per annum. 'Wild Queen 10th,' 364 days in milk, gave 10,044 lb. 'Darlington Cranford 3rd,' in the herd eight years, gave a total of 60,524 lb., or an average of 7565½ lb. per annum. 'Darlington Cranford 5th,' in the herd six years, gave a total of 59,921 lb., or an average of 9986⅚ lb. per annum. 'Lady Rosedale,' in the herd eight years, gave a total of 69,018 lb., or an average of 8627¼ lb. per annum."[2]

Shorthorn cows in the herd of Mr C. R. W. Adeane, Babraham, Cambridge, have for some years given an average of over 7500 lb. of milk per annum, one cow yielding 8507 in one year. In the herd of Bates Shorthorns owned by Mr George Taylor, Cranford, Middlesex, the average yield of several cows is from five to six gallons per day when in full

[1] From a Paper by James Macdonald in the *Jour. of the Roy. Agric. Soc. of Eng.*, 1883.

[2] *History of Shorthorn Cattle.* Edited by James Sinclair. Vinton & Co., Limited.

milk. A number of cows have exceeded 10,000 lb. in a year, and one reached a total of 12,320 lb.

Shorthorn Society and Herd-Books.

The interests of the breed are well looked after by the Shorthorn Society of Great Britain and Ireland. The society was founded in 1875, and in 1908 had over 1600 members. The *Shorthorn Herd-Book* was established in 1822 by George Coates, and the work still bears the name of its founder. Volume xxxvii. of Coates' Herd-Book, containing the lists of births for 1890, had 1834 entries for bulls and 3920 for cows with produce. Volume liii., published in 1907, and consequently containing a record of the births for 1906, shows a registry of 3800 bulls and 6760 cows with produce.

In the United States of America there is an enterprising Shorthorn Society which issues a Herd-Book for the breed. In the seventieth volume there are entries of 8299 bulls and 12,000 females. Yet there is no evidence to show that the States had even one Shorthorn previous to 1811. Canada's first importation was in 1832, when some animals of the breed were introduced from the States. Then the fourth volume of the Argentine Herd records 1084 bulls and 1173 female animals.

Exports of Shorthorns.

The trade in the exportation of Shorthorns continues to be large. From 1882 to 1890 the Shorthorn Society of Great Britain and Ireland issued certificates for the exportation of 3131 animals of the breed, while from 1891 to 1908 the certificates issued numbered close on 16,000.

For a quarter of a century the Argentine has been by far the best foreign customer for our high-class Shorthorns, but many fine animals have also been taken by Chili.

MANAGEMENT IN SHORTHORN HERDS.

No very hard and fast rules as to the management of Shorthorns can be laid down. Much depends on the district in which the herd is situated, on the object the particular owner has in view, and the outlet there may be for young stock. In Scotland, generally speaking, no one need attempt to raise Shorthorns successfully who has not comfortable buildings for winter. The same holds good to a considerable extent also in England and Ireland, although in the southern districts of both these countries it is possible to winter young cattle at any rate almost wholly in the open. Shorthorns also require a fairly liberal dietary all through the year. In most districts they will do quite well on grass alone during summer, especially where the calves suckle their dams, but in winter they must be liberally hand-fed, even when running on the pastures. In dairying districts where Shorthorns are used for the production of milk they have to be fed like ordinary dairy cows —on cake, bean-meal, or other material, in addition to grass, at least during the latter part of the grazing season.

North of Scotland Methods.

The northern counties of Scotland have achieved notable distinction in connection with Shorthorns. The management here is on rather special lines so far as other parts of the country are concerned, although it does not differ greatly from that of other classes of cattle kept in the same district. In Aberdeenshire, and the north of Scotland generally, it is necessary owing to the severity of the winter to house cattle for five if not six out of the twelve months of the year.

During this time the cows are tied up in byres and have everything brought to them. In former days it was quite a common thing for the animals to stand there right through the winter without once being turned out. But of late years, since the tuberculin test was discovered and the prevalence of tuberculosis has been more fully recognised, most breeders try to give their cows a turn out every day, if it is only into the yard. In justice to the old plan, it should be stated that the byres, as a rule, are airy and comfortable, and give a fair amount of cubic air space per cow.

Heifers and young bulls are usually accommodated separately in partially covered courts. Stock bulls frequently stand in the end of byres alongside the

cows, although in the larger herds they are usually housed in loose-boxes.

Feeding Methods.—Feeding in the north of Scotland follows the general custom in consisting for the most part of turnips and straw. North-country turnips have a feeding value of their own, and are fed in quantities which may surprise those who are not familiar with the local conditions. Thus, when the crop is a good one, they are fed three times a-day—morning, noon, and evening,—cows consuming from 25 to 35 lb. per head at each feeding-time. When the crop is a short one, the quantity is either reduced over the three periods or otherwise turnips are wholly omitted at mid-day, and a meal of cake, bruised grain, bran, or other artificial food substituted, with, of course, what straw the animals require. But there is no food that cattle, in this part of the country at any rate, do better on than turnips and straw, and all breeders grow a regular quantity of turnips every year for their cattle.

The young animals in the boxes are fed on pretty much the same lines as the cows, except that they usually have fewer turnips and more artificial food. A common allowance of turnips in the case of young growing heifers and bulls is 50 to 60 lb. per day. Linseed-cake is a good deal used for young stock, although cotton-cake also has its patrons. In the case of both, they are almost invariably fed before the turnips, as this is thought to prevent "hoven" and troubles of that kind.

Yellow turnips in Aberdeenshire and adjoining counties keep perfectly fresh up to March and April, when they are succeeded by swedes until the grass comes. In the case of swedes, it is usual to slice them, but to all except to animals rising two years old yellows are fed whole without much risk of choking or bolting.

While turnips are very wholesome as a rule, they should never be fed when in a frosted state, especially to in-calf cows. Cattle fed largely on turnips will not usually drink much water, but all the same, it is customary where water is not always available to give them the offer of it at least once a-day.

Calving.—Not having dairy exigencies to contend with, northern breeders usually aim at having calving-time arranged for the months of January, February, and March. Odd calves will come at other times, but the bulk of the calves have these months as their birth-dates. One advantage of this is, that when the cows go out to grass in May they have comparatively strong calves at foot. Calving usually takes place where the cow stands during the winter, although many breeders aim at having special accommodation for this purpose. When the cow calves, the calf is usually tied up beside the cow in a double stall. Until the calf is able to take all her milk, the cow is regularly milked by hand, the calf sucking at the same time, so as to encourage the cow to let down her milk.

Feeding Calves.—Many of the frequent and discouraging losses among young calves are believed to be caused by the allowance of too much milk at a tender age. It is better to keep the calves hungry than to allow them to gorge themselves for, at any rate, the first three weeks of their existence. Scouring, indigestion, the formation of wool balls in the stomach, and other evils, arise from too liberal or irregular feeding. When the cows go to grass the milk generally increases, and sometimes it is again necessary to resort to hand-milking to take away the surplus. After the calves are weaned, such of the cows as require it are also regularly milked. But this is only necessary, as a rule, in the case of extra heavy milking cows. Cows bred on beef lines, as they generally are in the north of Scotland, do not usually have more milk, unless shortly after calving, than the calf is able to utilise. With an extra heavy milking cow the expedient is sometimes adopted of putting on a second calf to suckle her along with her own calf.

In this part of the country suckling is the almost universal method of rearing Shorthorn calves. The calves are trained to eat oil-cake and sliced turnips as soon as possible, and are weaned at seven to eight months old.

The young bulls which are to be sold in autumn or spring get some oil-cake in the fields during the latter part of summer; but heifer calves, as a rule, depend entirely on their mothers and the grass.

Age for Breeding.—Heifers are generally put to the bull so as to calve at from 20 to 26 months old. This early breeding tends to reduce size, but this can usually be counteracted by a little extra feeding. The danger of putting off breeding until another season is that permanent infertility may ensue. A year's rest at three or four years' old generally enables an early-bred heifer to come to her full size.

Treatment of Bulls. — In the late Mr Cruickshank's herd at Sittyton, when the cows had calved about six or seven weeks, they were turned out with the bull every day, and in summer the bull grazed regularly with the cows. Running pretty constantly with the bull, it was thought that the cows came into use sooner than they would if separated from him, and were in no danger of being missed. On the other hand, one bull under this system does not usually beget so many calves as if kept alone and used sparingly. On this account many breeders adopt the alternative plan of keeping their bulls wholly in the house, and only bringing them out as required. When kept in this way bulls are fed on green tares or cut grass, with the addition of a feed of bruised oats, linseed-cake, or other artificial foods two or three times a-day. Exercise in such a case is given by the attendants taking the animals out for an hour or so each day.

Methods in South of Scotland and North of England.

In the central and southern districts of Scotland management is on pretty much the same lines as farther north, except that turnips are not quite so extensively fed. In a few cases hay is also substituted for part of the straw, the straw farther south not always being so valuable from a feeding point of view as it is in the north.

Alnwick Park System.—The system followed in the south of Scotland and the northern districts of England, outside Cumberland, is well illustrated by what is done in the Duke of Northumberland's extensive herd at Alnwick Park. Here the method of management is substantially as follows: Roots, hay, and straw constitute the principal winter food, with the daily addition of not more than 3 lb. of linseed- or cotton-cake, for each breeding cow or heifer. When turnips are scarce or not available at all, mashes of ground oats, barley, beans, and maize and bran, are given, or a liberal supply of linseed- and cotton-cake is used along with the hay and straw. The food of the stock bulls in winter is usually turnips and hay, ground oats, and about 3 lb. of linseed-cake per day. In summer they get grass and tares in lieu of hay, with the same quantity of ground oats and linseed-cake. Bulls kept in the house get exercise every day.

The majority of the calves suckle their dams. As soon as the 12th of May comes round, and the weather is favourable, all the breeding animals are turned out to pasture, their calves with them, until late autumn. The cows get no artificial feeding in summer, but a corner is railed off somewhere to which only the calves can have access, and here they get a little cake once or twice a-day.

As the season advances, the cows with early bull-calves are separated from those having heifer-calves. An effort is always made to have a good aftermath field for the bull-calves and their dams. This not only gives a nutritious feed to the calf, but increases the flow of milk in the cow.

Housing time depends on the weather. October, however, is the general month. When housing does take place, most of the cows are tied in byres, and the strongest calves—bulls and heifers—put in batches into separate folds. Such calves are allowed to suckle their dams twice a-day up to weaning time. Cows with very young calves are put into boxes together. By the time the weaning of the calves begins they have been taught to eat cake and possibly cut turnips. The check from the milk is therefore scarcely felt.

At Alnwick Park, any more than in the north, it is not found that the suckling system prevents the cows from coming early into use after calving, though occasionally heifers which have had their first calf while still very young are long in taking the bull in the same season. Indeed they often take a considerable rest before having a second calf. Cows in the Alnwick Park herd breed regularly up to twelve or thirteen years old;

a few will go on even to sixteen or seventeen.

Cumberland Methods.—In Cumberland and Westmorland a somewhat different system of management prevails. There, the cattle are mainly in the hands of tenant-farmers, and are kept chiefly for milking purposes. The management is more economical than it usually is in the case of costly herds in the hands of wealthy owners. The Cumberland and Westmorland farmer hand-milks all his cows, and feeds his calves by pail. The calves get a small allowance of new milk for a time, but gradually they are turned on to skim-milk, to which is added porridge made of linseed and maize-meal when the animals are old enough to take such food with safety. When they begin to nibble, dry food, consisting of broken cake, bruised corn, or bran, is placed within their reach.

In these parts cows lie out all summer and autumn. Their winter food consists, as a rule, of turnips and straw, although some breeders are rather more liberal, and give a moderate allowance of crushed oats and decorticated cotton-cake along with the pulped roots and oat-straw.

Young bulls which are being fed for sale receive extra keep in the shape of linseed-cake and bruised oats. They are usually kept in well-ventilated sheds, so that they have abundant coats of hair. In spite of their economical system of feeding, the Cumberland and Westmorland farmers often turn out remarkably good Shorthorns, and this from farms ranging in height from 700 to 800 feet above sea-level.

South and West of England Systems.

Different systems of management prevail in the southern and western districts of England. Cattle here can be kept much more in the open, and they do with less substantially built houses than farther north. At Morgenau, South Wales, for instance, Mr Morgan Richardson's cattle are sometimes in the field as late as the middle of December, and return to them again as early as the middle of March.

In these districts, as elsewhere, management depends on the particular object of the owner. Should the herd be a specially valuable one, and devoted to bull-breeding and beef-production, the cows, as in the north, are timed to calve, as far as possible, in the three first months of the year. For most of the leading shows, as well as for the Herd-Book, ages are reckoned from the 1st of January in each year, and if the calves are born much outside the first three months they are apt to be out-classed for the first season, if not for succeeding seasons also. The aim of the breeder is, therefore, to have the calves as early in the year as the climatic and other conditions of his district will permit.

Morgenau Herd.—A good example of the system in a bull-breeding and showing herd is that followed in the Morgenau herd already referred to. In this herd no corn or cake is given to the breeding cows. In winter they get nothing but hay and chopped straw, with roots and cabbage. Mr Richardson says that at one time he tried milking his cows by hand and feeding calves by pail, but he found it unsatisfactory, and now his cows suckle their calves. Under this system there is sometimes a difficulty with a young bull that has been suckled for six or eight months, and whose dam is getting well forward in calf again. But in such a case the calf can usually be induced to draw from another cow and allow his own dam to go dry. Mr Richardson, like most breeders who bring out young animals for show purposes, is a great believer in the virtue, in such cases, of milk, and plenty of it. Nothing, he affirms, will grow bone, muscle, and hair like milk, preferably suckled by the young animals as they require it.

Those who give attention to the question of sustained progress in young Shorthorns will be interested to know that at Morgenau a system prevails of taking the girth of calves every fortnight. Every bull-calf is expected to girth not less than 2 feet 6 inches at birth, and to make an average increase of 1 inch a-week until he is six months old, and about 1½ inch per fortnight between the ages of six and twelve months. A bull-calf, in Mr Richardson's experience, should measure no less than 4 feet 6 inches at six months old, and 6 feet at twelve months old.

Buscot Park Herd.—Similar methods are pursued in Sir Alex. Henderson's herd at Buscot Park. The cows are out at grass all through the summer. Some of the best milkers, and especially those that are rearing calves, have a small allowance of feeding cake, crushed oats, and mangolds, but otherwise they have to provide for themselves in the fields. The cows are brought up twice a-day for milking, or to suckle their calves. The winter feeding consists of an allowance of about 7 lb. of meadow-hay twice a-day, mangel pulp, and oat-straw chaff *ad lib.*, with, in addition, 5 to 6 lb. of linseed or other cakes, crushed oats, and patent foods. The bulls are fed in a similar way. The best bull-calves are allowed to run with their dams until they are five or six months old. As soon as they will eat they have some sweet meadow-hay given them, and some finely-ground linseed-cake, crushed oats, and a little bran and hay-chaff.

Methods in Ireland.

Except that the animals can be kept out of doors longer than even in the south of England, the management of Shorthorns in Ireland does not differ materially from what is practised on the English side of the Channel. If the rainfall is heavier, the general conditions otherwise are not unfavourable. In the case of bull-breeding herds calves arrive, as in Scotland and England, during the first three months of the year. Dairying herds, on the other hand, have their calves arriving all through the year, to suit the requirements of the milk trade. Where turnips are not largely grown their place is taken by cabbages, hay, mangels, or artificial food.

Calves, as a rule, are pail-fed here, unless in the case of heifers with their first calves, these being allowed to suckle their calves. Some years ago breeders, in order to save new milk in rearing calves, adopted the plan of boiling down whole flax-seed into a mucilage and adding it to milk. The flax seemed to do well enough for a time, but ultimately it was found to set up disease of the kidneys, and is not now used to any large extent. Linseed and maize-meal is now the general partial substitute for milk, although various kinds of calf-foods are also used. Young stock in the south of Ireland especially can go out practically all the year round.

In Irish herds the usual practice is for heifers to drop their first calf when they are about two or two and a half years old.

Management in Dairy Herds.

Where dairying is the principal object different times of calving have necessarily to be adopted. In some cases it takes place all over the year; in others, mainly in the autumn.

In the Shorthorn dairy herd kept at Kelmscott, Lechlade (by Mr R. W. Hobbs), cows go to grass all summer, those giving 20 lb. of milk daily being allowed 4 lb. of cotton-cake. In winter they are tied up in sheds and fed with one meal of hay and chopped straw, with about 56 lb. of mangels or cabbages, about 8 lb. meal and cake (mixed dried grains, soaked maize, germ meal, and decorticated cotton-cake). The stock bulls are kept loose in boxes as much as possible, having cut grass in summer and hay and straw chaff with pulped mangels in winter. Young bulls for sale have, in addition, linseed-cake, crushed oats, and bran.

Calves go with their dams until they are fourteen days old, when they are taken away, taught to drink, and given milk for a few days. As soon as possible they are turned on to some cream equivalent. This is continued for twelve or thirteen weeks, after which they are allowed 2 lb. linseed-cake, hay, and a few roots. The linseed-cake is continued when they are turned out to grass in May. By September they are taken into the yards and given one meal of hay, straw-chaff, mangels, and 2 lb. meal, in addition to straw at nights. The following spring they run on grass with no additional feeding, and most of them run out all the succeeding winter, coming into the yards for hay, which, if short, is given sparingly, and 3 lb. of cotton-cake added.

Bulling is begun in December, so as to ensure a winter supply of milk in the following year. The ordinary cows, however, calve from 1st September to 1st June.

Milk is also the principal consideration in Mr C. R. W. Adeane's herd at Babraham Hall, Cambridgeshire. Here the cows are kept in sheds during winter, but go out three or four hours a-day on the grass, while in summer they stay out the whole time on the pastures. When grass is short, mangels, kohl-rabi, swedes, and oat-chaff with a little hay are given. Cotton-cake and crushed oats are the principal artificial foods in winter. Bull-calves in this case are taken from their dams when three days old and brought up by pail, having milk for about six weeks to two months. Young stock, as soon as they eat, have crushed oats, linseed-cake, bean-meal, and bran. The cows, not including heifers with their first calf, will average from 650 to 700 gallons of milk per annum.

A portrait of a characteristic bull of the Shorthorn breed is reproduced in Plate 26. A noted Shorthorn cow is represented in Plate 27.

THE LINCOLNSHIRE RED SHORTHORN.

Origin.—The Lincolnshire Red Shorthorn has since 1890 attained to the status of a distinct type, if not a distinct breed. It is sometimes referred to as a "sub-variety" of the Shorthorn. Yet, while the Shorthorn has been used successfully in forming the modern type of the Lincolnshire Red cattle, it is known that for over a hundred years red shorthorned cattle have been associated with the county of Lincoln. The cattle were then of enormous size but of slow growth. The growth has been accelerated by modern improvements.

Early Improvement.—The date of the improvement of the Lincoln Reds is first traceable to the year 1810, when three bulls were sent into Lincolnshire from Charles Collings' sale.

Mr Thomas Turnell's Herd.—Probably the most potent factor in producing the breed as now known was the herd owned by Mr Thomas Turnell at Reasby, near Wragby, towards the close of the eighteenth century. Arthur Young says that "Mr Turnell has a breed of cattle which are not surpassed by any in the county for points highly valuable, or their disposition at any age to fatten rapidly. His bull covers at a guinea and has many cows sent to him. This breed originally came from the neighbourhood of Darlington." He further describes these cattle as of medium size, but he preferred the larger ones.

There are no minute records available, but the fact that the Reasby herd attained to considerable eminence is made clear by the acknowledged influence which the "Turnell Reds" exercised. The fine rich cherry-red colour which has been the fashion in all ages was one of the special features of these cattle. The scale Mr Turnell reduced, aiming at more flesh and quality than they apparently then possessed.

Later Improvement.—At a later time, approaching the middle of the nineteenth century, herds owned by Mr Coulam of Withern, Mr Baumber of Somersby, and Mr Oliver of Eresby did much to extend the county reputation of the Lincoln Reds. Mr Cartwright of Tathwell had likewise a celebrated herd whose dispersion in 1844 scattered good blood throughout Lincolnshire. Again the name of Chatterton stands high in its association with the breed, and by the use of the Coates' Shorthorn was partly responsible for altering the character. The "Old Welbourn Reds," too, had a fine reputation, Messrs Burtt of Welbourn being amongst the oldest supporters of the race.

Records of herds exist for a period of 100 years, the type of cattle gradually conforming to one colour.

Herd-Book.—Volume i. of the Lincolnshire Red Shorthorn Association was issued in 1895, and contains, besides herd histories in brief, a record of 293 bulls. The Association has been conspicuously successful in bringing the Lincolnshire Red Shorthorn to the front, by offering prizes at leading shows and in other ways serving the best interests of the

breed, which stands under a separate classification at the Royal English Show.

Characteristics.

Description.—It is unnecessary to elaborate a description of the breed. There is no official standard, save that the cherry red is the acknowledged colour, and white markings are no disqualification, although looked upon with disfavour. By taking a good type of Shorthorn with a little more than average size and robustness we have the model for the Lincoln Red.

Aims of Breeders.—To thoroughly understand and sympathise with the objects Lincolnshire breeders have in view, it is necessary to remember that Lincoln is a county where the ideal of the breeder is to produce big stock. The land is capable of carrying large-sized animals, therefore why not make the most of it? Perhaps this point may be presented with greater emphasis if it is borne in mind that the Lincoln sheep is amongst the weightiest and sturdiest of the ovine race; the Shire horse associated with Fenland is the weightiest type of that breed; the curly-haired pig, one of the latest recruits to pedigree, is deemed to be about the largest and heaviest of the porcine tribe in this country. Moreover, Lincolnshire markets can assimilate heavy stock.

Robustness of Constitution.—The Lincolnshire Red Shorthorn cattle owe much of their popularity to the robustness of their constitution. Breeders declare that while they have to house their Coates' Shorthorns, they can leave their Lincoln Reds on the fields to look after themselves. Any one with a knowledge of the flat lands where they are wintered in the southern parts of the county will readily grant that only animals of great constitution could "rough it" as the native Reds do there during an inclement season.

Size, therefore, is one of the chief distinctions between the Lincoln Red and the Coates' Shorthorn. The second point is that they have superior constitutions.

Flesh-bearing Qualities.—No doubt as long as there is a north and a south, Lincolnshire breeders in extremes of the county will never quite agree as to the correct type. There will be large cattle and medium-sized cattle—the latter still larger than the average Shorthorn. The use of Coates' Herd-Book bulls has done much to increase the flesh-carrying qualities of the modern type.

At one time it was commonly noticed that many of the show cattle lacked finish and wealth of flesh. To-day, however, breeders are more experienced, and show their stock with as great a wealth of flesh as almost any other breed. Flesh-bearing properties can be bred into stock as well as cultivated by skilful feeding. The fact that Coates' Herd-Book bulls have been freely used with success, and that the best cattle are now well got up for show, will undoubtedly affect the flesh-bearing character of the produce.

Type.—There is less divergence in type to-day than at any time in the previous history of the breed. Gradually the thick, short-legged, wealthily-fleshed Red Shorthorn type is prevailing. There is a greater size of frame than is noticeable in the Scottish stamp of Shorthorn, and breeders, in their efforts to keep to a type denoting quality, are not likely to forget that if they do not maintain the scale they are losing a potential characteristic of the breed.

Colour.—The colour favoured is a cherry red. Faded reds and reds of yellow shade are often met with, but they are rapidly disappearing from the best herds. Bulls of incorrect shade find few buyers, and the prices obtained speedily impress upon the breeder the necessity of keeping the rich cherry red in view. A few white marks on the vessel or underline are not a disqualification, although if they get as far as the dewlap they are a distinct objection.

Weights.—The weights to which the breed will grow are remarkable. Bulls scaling over 23 cwt. alive have been known. Stall-fed show cattle will weigh up to 24 cwt., while grass-fed three-year-old bullocks average from 8 to 10 cwt., scaling much more when fat. Lincolnshire is essentially a grazing county, and a large number of cattle are fattened there as three-year-olds. Good root crops and rich pasture are obtained in return for caking animals on the land—a system locally known as "begging keep."

Milking Qualities.—As a rule, the system of rearing in Lincolnshire herds is to allow the calves to suckle the cows. This does not encourage a high yield of milk. Yet the reputation which the breed has established outside of the confines of the county is to all intents and purposes that of a fine milking race.

The Burton Herd.—The eminence of the Burton herd, owned by Mr John Evens, and situated close to the county town of Lincoln, has provided another feather in the cap of the breed. For over twenty-three years Mr Evens has kept exhaustive milk records. His aim he tersely describes as "milk combined with size, quality, and constitution." He began showing at the London Dairy Show in 1887, and since then he has had one long record of success. The following comparative statement of the annual yield of milk by cows in his herd is interesting:—

No. of Cows.	Year.	Average yield per Cow. Gallons.
31	1890	740
35	1891	720
34	1892	795
38	1893	732
39	1894	834
43	1895	867
43	1896	889
36	1897	881
38	1898	824
34	1899	860
36	1900	785
48	1901	758
40	1902	776
42	1903	780
43	1904	842
54	1905	816
48	1906	802

Individual yields have been very large. Thus in 1906 ten cows out of forty-eight gave over 1000 galls., the highest being 1602 galls., an average daily yield while in milk of 32 lb. One of his cows holds the record for the largest yield in twenty-four hours at the famous Tring milking trials.. She gave 7½ galls.

MANAGEMENT.

The management of herds varies according to the aims of the breeder—whether the primary object is milk or bull-breeding. Mr John Evens believes that "like produces like," and has saved his bulls from deep milking cows. The female calves are kept in natural condition, the best being always retained in the herd. Mr Evens is of opinion that the bull has more influence in transmitting dairy qualities than the dam. He buys one or two of the best pure-bred dairy cows in order to breed his own stud bulls, thus procuring a change of blood.

Treatment of Cows.—The methods of cow-feeding pursued by Mr Evens are well planned and are carefully carried out. In May or June, if the grass is plentiful, the cows are given 2 lb. cotton-cake, and later, if the grass is scarce or dried up, about 3 or 4 lb. of mixed meal or bran per day with it, and either cabbages or lucerne thrown in the fields. Towards the autumn a change of pasture is provided if possible, usually grass "eddish."[1] The winter daily rations are 4 lb. cotton-cake, 2 lb. malt coombs, 2 lb. dried grains, 2 lb. bran, and 3 lb. mixed meal, generally oats and wheat. In autumn, 40 to 50 lb. cabbages, and later, 40 to 50 lb. swedes, are provided; after Christmas, 40 lb. mangels, when ripe, good oat-straw, long hay once a-day, water always before them, a trough between two cows.

In his method of preparing the foods Mr Evens steeps the dried grains and malt coombs for twenty-four hours. Then these wet grains, coombs, bran, and meals, with a very few pulped roots, are mixed with good oat-straw about twenty hours before using. A few handfuls of salt are thrown in. The mixture must not be allowed to ferment, otherwise it will taint the milk. Cows receive two feeds per day, and one feed of long hay at night. This latter is necessary to enable them to raise the cud. The cake is given dry—roots and cabbages being fed twice, morning and afternoon.

Mr Evens milks his best cows, two or three calves being suckled on cows not intended for use in the herd. The heifers are calved just under three years old. His land is not capable of growing them big enough to admit of a calf being taken earlier.

General Methods.—Cattle in Lincolnshire are usually housed from the middle of October to the end of April to protect them from the cold east winds and to tread down a large quantity of straw.

[1] Aftermath.

The usual method of managing a herd in the county is to suckle one or two calves on a heifer and sometimes a third on the cows. The cows are either fed off or sold lean after the third calf. The young stock are allowed to grow in store condition. The heifers are put to the bull at two years old. The steers are brought out fat from two to three years old, and if well done from birth will finish about 60 st. (14 lb.) beef from two to two and a quarter years.

The cattle are wintered out of doors. The wind-swept, bleak countryside is no nursery for the delicate constitution, but the cattle do fairly well with a little hay. Lincolnshire is a corn-growing county, and manure must be made and trampled. Open yards are usually provided on Lincolnshire farms, which while they may not improve the quality of the manure, at least ensure healthy stock. Large numbers of these bullocks go in spring at about two to two and a half years old to the better pasture lands of the county to fatten off during summer. These will kill about 60 st., and if kept on to the following autumn will "die" up to 80 st.

A typical Red Lincoln Shorthorn cow is represented in Plate 28.

HEREFORD CATTLE.

There is no other breed in this country comparable with the Hereford in its happy combination of commercial beef-making qualities and picturesque appearance in the field. It is unsurpassed as a grazier's beast; indeed, grass-fed Herefords sell better than any other class of cattle in the fat markets of the midlands of England.

Origin.—The generally accepted opinion as to the origin of improved Hereford cattle is, that they trace directly from the aboriginal cattle of the county of Hereford and adjoining districts. The improvement was begun far back in the eighteenth century, by the Tomkins family. There is abundance of evidence to show that, as early as 1766, it was taken up in a systematic manner by Benjamin Tomkins, who continued the work with great energy and success until his death in the year 1815. For four years after, his herd was maintained by his daughters, and when it was dispersed by public auction in 1819, one year after the famous Barmpton sale of Shorthorns, twenty-eight breeding animals realised an average of £149 per head —four adult bulls bringing £267, 15s. each, and two bull-calves £181, 2s. 6d. each.

Other early breeders of skill and enterprise took up with commendable spirit the work which had been so well begun by Tomkins, and to their successful efforts the Hereford farmers of to-day are indebted for a valuable race of rent-paying cattle.

It is generally considered that infusions of foreign blood have contributed to some extent to the building up of the improved Hereford. In the history of this breed,[1] it is mentioned that in the seventeenth century cattle had been imported into Hereford from France by Lord Scudamore, and that in later times there have been introductions of stock into Hereford from various parts of England and from Wales. Undoubtedly, however, the dominant ingredient in the improved Hereford is the aboriginal race of the county—the same race of cattle which under different conditions of soil, climate, and management, have given us such breeds as the Devon and Sussex.

The white face has been well described as the "tribal badge" of the Hereford, and we are told that this distinctive mark is traceable to the infusion of foreign blood referred to.

Many animals of the breed were at one time grey or spotted in the face, and even yet there exists a strain of Herefords known as "Smoky-faced Montgomerys."

Characteristics.

Uniformity of Type. — No other breed has more clearly defined character-

[1] *History of Hereford Cattle*, by Macdonald and Sinclair. Vinton & Co., Limited, London.

istics than the Hereford. It is certainly a unique tribute to its wonderful constancy in breeding—and thereby one of the strongest proofs of the purity of its ancestry—that the markings should be so clearly and persistently maintained in successive generations.

Colour of Herefords.—The colour of the Hereford is the first thing that strikes the observer. The white clean face, the white shoulder tops, the white dewlap, the rich red hue, all go to form a striking picture. In the matter of colour it is worthy of note that dark-reds are not favoured, neither are light-coloured cattle. The red that does not contain even the suspicion of a black hair, nor the suggestion of a yellow one, has always been associated with the best animals in the showyard. The rich curly coat is as sure a sign of a truly bred Hereford as the white face and clean muzzle.

General Appearance.—The typical Hereford is a fine massive animal. Its broad back, deep ribs and well-lined flanks, square quarters and well-built-out rumps, undeniably indicate the prime butcher's animal. No other breed possesses such a rare wealth of dewlap, such conspicuous spread over the top, nor in the average such well-rounded ribs. The typical Hereford is level in flesh, bulky in form, and built nearer to the ground than almost any other breed.

Standard Description.—In 1905 the Hereford Cattle Breeders' Association issued a standard description of the breed. It is pointed out that there are difficulties surrounding a scale of points for the breed, as breeders' ideas are so much at variance. The circular remarks: "It is a common saying that beef does not grow on horns, yet a breeder who aims to produce fine breeding stock would fail in his purpose if he neglected to place full value upon the shape and colour of the horns." The description is as follows:—

"The bull should have a moderately short head, broad forehead, and horns nearly resembling the colour of wax, springing straight out from the side of the forehead, and slightly drooping; those with black tips or turning upwards are not regarded with favour. The eye should be full and prominent, the nose should be broad and clear. A black nose is objectionable. The body should be massive and cylindrical, on short legs, the outline straight; chest full and deep, shoulder sloping but lying well open at the top between the blades; neck thick and arched from the head to the shoulders, ribs well sprung, flanks deep, buttocks broad and well let down to the hocks; the tail neatly set and evenly filled between the setting of the tail and the hip bones, which should not be prominent. The whole carcass should be evenly covered with firm flesh; the skin should be thick and mellow to the touch, with soft curly hair of a red colour; but the face, top of neck, and under parts of the body should be white.

"The same description should apply to the cow, excepting that she should be grown upon more feminine and refined lines, the head and neck being less massive, and the eyes should show a quiet disposition."

The circular embodying the above description, which, curiously enough, does not refer to colour, concludes as follows: "The Hereford is essentially a beef breed, and reaches maturity at an earlier age and at less cost than any other breed; the steers readily fatten at two years old on grass alone, and in the summer months they command the top price in the London market."

Constitution.—At one time the Hereford was used as a beast of burden, in the sense that it bore its share in the tillage work of the farm. To this is no doubt attributable the strength of its frame and its constitutional vigour. Nowadays it is employed in a more peaceable and equally useful manner, turning a profit from the fine grazing lands in the midlands of England.

Freedom from Tuberculosis.—A noteworthy feature in the Hereford breed is its freedom from tubercular disease. Shipments of cattle to the number of one hundred have been sent abroad, not one of which reacted to the tuberculin test. This advantage has not been purchased at the expense of aptitude to fatten. It is attributable, in the first place, to the constitution built up in the early days at the plough. That vigour has not been assailed by a pampered system of rearing. The Here-

ford is a grass fattener, and the open air is the finest antidote to tuberculosis that we have yet discovered. Fattening at grass or finishing in the open court, the Hereford has access to the open air. In the case of stall-fed bullocks the confinement implies less fresh air, and providing disease with a lodgment where it can be communicated.

Milking Qualities. — The Hereford has won so great a reputation as a beef-producer that probably few people outside of the circle of breeders would associate it with milk-production. There are milking strains, however, which give no mean results. The majority of Hereford breeders do not wish to breed for beef alone, without recognising the importance of the cow's ability to rear her own calf. This is the prevailing practice in Hereford herds. Admittedly, this is not the means to be used if milk is to be encouraged as a commercial asset, but no one is likely to take the Hereford cow for milk-production when he can do better with breeds like the Shorthorn. The assertion is sometimes made, however, that the show Hereford is purely an animated block of beef. Milk secretion is deficient. Doubtless it is in many cases, but the fact should be borne in mind that Mr William Tudge of Summer Court, Kington, has bred cows that have won prizes at dairy shows.

A Milking Herd.—In the herd owned by Mr White of Zeals, Wilts, attention is particularly devoted to the cultivation of milking qualities. The calves are allowed to suckle the dams for a week, and are then reared by hand, too much condition not being favoured. Mr White, from eighty cows, sent in two months, May and June—this being an ordinary extract from his records—5400 gals. of milk to the factory, from which 5444 lb. of cheese was made. This is no mean performance, considering that it was only part of the milk. In 1905 the eighty cows at Zeals Park produced 38,500 gals. of milk. Although this does not seem an exceptionally high average, it must be borne in mind that the cows had no artificial food during the year except in the spring and after calving. A fair sample of May milk was submitted for examination, and it averaged 4.3 per cent of fat.

Weights.—Good grass-fed Hereford steers weigh alive from 10 cwt. to 12 cwt., handy weights, which are much appreciated by Midland butchers. At Smithfield Show a class of nine steers under two years averaged over 13 cwt., and in the class between two and three years old the weights averaged close on 17 cwt., which is clear proof of the breed's aptitude to fatten rapidly.

For Crossing.—The Hereford is perhaps, considering its fine beef-producing qualities, not so much used for cross-breeding as could be desired. Probably it is thought best to keep its grazing qualities unalloyed. Abroad on the prairies of the new hemisphere, on the bare lands of the veldt, and on the sun-burned pastures of the antipodes the Hereford flourishes. It is no mere trite observation to say that it thrives under these conditions better than any other breed. One of its chief claims to the support of the foreign buyer is that it is the best of all foragers when circumstances compel it to seek for its living. A large export trade is carried on to North and South America, to South Africa, and Australia.

In the Showyard.

Hereford cattle do well in the show-yard. There is no lack of herds in the bull-breeding business, and that being so, there are numerous exhibitors. For a time breeders seemed to attach almost undue importance to quality, sometimes at the expense of scale and weight, favouring very short, compact, thick animals. There is, however, a greater disposition now prevailing to give substance and size their due, recognising that in breeding it is easier to lose weight than to regain it.

MANAGEMENT.

The management of Hereford breeding herds does not vary much. In Mr Allen E. Hughes' herd at Wintercott, Leominster, the practice is to run the cows at pasture with the heifer-calves during the summer months. The bull-calves are separated from the dams, being suckled night and morning.

Treatment of Cows. — When the cows come into the yards in the autumn

they get out straw and "rowings" (the chaff and riddlings from the straw when threshing) until they produce their calves. Then they have pulped roots and chaff once a-day. The cows are allowed to run in a meadow for a few hours daily, and later on in the spring they have hay until turning out to grass. The natural plan of keeping the cows out in the open yards all the winter is followed. When they are ready for calving they are put into loose-boxes, and are in them for a few weeks, and then turned out in the open yard, coming in to suckle their calves night and morning.

Treatment of Calves.—Mr Hughes tries to get his cows to calve after 1st January. He takes the calves from the cows when about eight months old. The heifer-calves receive about 1½ lb. of oat-flour in the morning with chaff, finger-sliced roots twice a-day and hay. The bull-calves during the summer have mixed flour and cake, and run out at grass. After they are weaned they are put in boxes and have flour, roots, and hay.

Management of a Milking Herd.—As an example of management under different conditions—*i.e.*, with milk as a prime object—Mr White's system at Zeals Park in Wilts may be summarised. The herd has a run of 180 acres grass-land, of which one-third is mown for winter consumption. The cows are kept throughout winter on oat-straw. They are allowed the run of pasture until a fortnight prior to calving, when hay and straw-chaff with roots are given them, with the addition of 4 lb. of cotton-cake per day. The calving season is in April and May, when the grass begins to be plentiful. The calves suckle the cows for a week, and are then hand-reared, most of them being sold for veal, which in Mr White's opinion is more profitable than keeping them on for beef. Several bull-calves are saved, however, and are sold for use in dairy herds as far south as Cornwall. The heifer-calves to be kept in the herd are reared by hand, receiving about a gallon of milk daily, till they can eat a little cake and other artificial food and hay. They run on the grass throughout the summer, receiving a little linseed-cake. In winter they are transferred to a sheltered field and subsist on hay only.

The bull is put to the yearlings about the end of July, so that they may breed at two years old in April. This early breeding is encouraged in the belief that the udders developing early do better before the natural beef-making qualities of the breed begin to assert themselves.

The cows are generally at their best as milkers with the third calf. The cows are milked up to the day of calving. Mr White's experience is that they are difficult to dry off, while the heavy milking does not in any way mitigate their natural aptitude to fatten. They produce the milk more cheaply in this way, and cost nothing in artificial food to fatten them.

Management in the Montford Herd.—Mr T. S. Minton, Montford, Shrewsbury, believes that in rearing bulls it pays to be liberal with them, provided the breeder is careful not to surfeit. Discussing the question when to take a calf he says: "Many breeders differ in opinion as to the time a heifer should have her first calf. I think it is at two years two months, which would be March if she was calved in January. Her calf would then be ready to take all the milk by grass time. The dam would not have lost her milk by calving too long before grass is ready, which is often the case with heifers. The plan of heifers not having their first calf till three years old is very prejudicial to their milking properties. If you want a good-looking herd have your first calf at two years two months, and then rest your cow, having your second calf at four years."

In Plates 29 and 30 portraits are given of a noted bull and cow of the Hereford breed.

DEVON CATTLE.

The Devon breed has played an important part in the history of beef-production in England. It is kept in a circumscribed area in the south-west from Dorset to Cornwall, and on the north bounded by the Bristol Channel. There are a few herds to be found farther afield, but if we except the royal herd at Windsor, they have not played a prominent part either in the public ring or in racial improvement. The history of the Devon, or "Ruby" as it is sometimes called, goes back far into the past. The red lands of the south-west have reared for generations red-coated cattle, and a singularly brilliant, active, and useful agent the breed has been in the agricultural evolution of Devonshire and the surrounding counties.

Early History.—Of early breeders of note information is provided by Arthur Young's Chronicles. In his famous report of 1776 the agricultural historian of two centuries ago makes prominent mention of the old Quartly race of cattle. Mr Quartly of Molland was the most celebrated of breeders in North Devon in the time of Arthur Young. The objects which Quartly and other breeders had in view were thus described by Young:—

"The points they have aimed at in breeding have chiefly been to gain as great a width as possible between the hips; to have the hip-bones round and not pointed; that the space from the catch to the hips should be as long as possible; the catch full, but not square; that the tail should fall plumb, without a projection of catch and rump; to have the tail not set on high—not to rise—but be snug, and the line to be straight with the backbone—no pillow just below the cross-line from pin to pin; to be thick through the heart under the chine; that the shoulder-point be not seen—no projection of bone, but to bevel off to the neck, all elbowing out being very bad. All the bones to be as small as possible; the rib-bones round, not flat; the leg as small as possible under the knee; not an atom of the side to have any flatness. In respect to size, if other points be the same, he prefers a small cow rather than a large one for breeding a bull, because it is very rare to see any very large one handsome; but to breed oxen, a large cow. To have them sharp and thin from the throat to the nose; in the throat the cleanest have small variations from the perfect snake; though fat there, it should not bag. To be thin under the eyes and tapering to the nose, which should be white, but the original breed was yellow. Between the eyes to be rather wide; eyes themselves to be very prominent, like those of a blood-horse, and no change of colour round them. The horns to be white, with yellow tips; thin at root and long, spreading at the points. The breast or bosom should project as much as possible before the shoulder and legs; and the wider between the fore legs the better. To have the line of the neck from the horns to the withers straight with that of the backbone. The belly to be light and rather tucked up; if fat before the udder, it is a sign of a good milker."

The Quartly Herd.—Any one who knows the Devons of to-day would readily recognise in the ideal cattle thus portrayed the true progenitors of the improved breed. Intelligent breeders with so clear an ideal, so well-defined a model, and the relation of all important points so well reasoned out, could not fail to leave an almost indelible stamp upon the race on which they operated. No wonder that the fame of the Quartly Devons still lives, for the efforts of Mr Quartly must have done much to mould the breed into the strongly set type which it now displays. Young tells us that the points which he describes so fully are the points which these gentlemen considered desirable to breed for in Devon cattle, which "they consider as the best in England"; and he adds, "Of their fattening qualities they observed that the Somerset graziers are the judges, who are known to prefer them. For working none can excel them. As milkers they are represented as possess-

ing much merit. They had two cows that gave each 17 pints at a meal, and would make in general 10½ lb. of butter per week in the flow of the season." The systematic improvement of Devon cattle as a breed began with this Mr Quartly. He stated to Young that his father had begun breeding Devons about twenty years earlier—twenty years prior to 1776—and that he thought the breed there or elsewhere was no better then, or at any rate "two years ago," than it was when his father commenced, so little progress had there been made by any one in improving the breed. About this time, however, the demand for Devon cattle began to increase, giving a stimulus to the good work so systematically taken in hand by Mr Quartly and a few other men of "light and leading."

Down to this day the Quartly strains are held in high esteem by all the leading breeders.

The Modern Devon.

The modern Devon embodies two different types—the North Devon and the Somerset Devon. This distinction has gradually come to be recognised. The former is the smaller of the two, and, on the whole, we may aptly term it the sweeter. Of late years a disposition has been manifest to increase the size without sacrifice of quality. It is felt by breeders that a little more weight would not come amiss, provided the "waste" of the carcase could be reduced. It has been amply demonstrated that to carry beef, bone and muscle are necessary, and in Devon cattle there may have been a tendency to run to the extreme of quality. At all events, there was a great temptation to produce a pretty little beast which, on some of the strong lands which carry Devon cattle, could not be fed so profitably as Devons of larger scale. It has come about in the showyard that the larger type is winning most of the honours, and what the showyard says to-day all Devon breeders must agree to-morrow.

The old type of mottled Devon is still met with, but there are fewer of the old drooping-horned cattle than were at one time seen. Indeed, the tendency in this respect is rather in the other direction, and who shall say that the horn gracefully curving upwards does not make as neat and pretty a head as any? At the same time, there is often a lack of sweetness and femininity in the heads and horns seen in the modern showyard. The Shorthorn type of head is not infrequently met with, the "form" being as shapely and symmetrical as ever.

The complaint is all too frequently heard, "We can't win with the little things nowadays." But there is room for the two types, although one of them must become the predominant partner, if we may judge from the manner in which events are shaping themselves. It should be borne in mind that on the higher-lying lands the Devon has to find a living, and very often the smaller cattle are, under these conditions, the more profitable to rear.

Appearance.—There is no official description of the Devon breed. In appearance it is of a rich uniformly red colour. Symmetry is a strong point. The frame should be well balanced, the flesh being carried right down to the hock joint. The typical Devon is built near to the ground. His head should be well set on a clean-cut neck. The horns curve outwards, then upwards, and should be fairly open. The head is wide at the base, the eye prominent and kindly, the nose short, and the muzzle broad and free from dark spots. The neck should fit into the shoulders, which should be free from coarseness at the points. The top of the shoulder should be broad, the chine of the Devon being essentially built for beef-carrying. The dewlap should be well developed and hang at a right angle. The ribs should be well hooped, so that a deep roast can be carried. They should also be deep, the flank forming the lower side of a parallelogram. The quarters should be long from the pin to the tail head, and any tendency to shortness of second thigh, although a somewhat common fault, should be condemned. The legs should be well placed outside the body. No white patches should be noticed on the skin, which should be mellow and thick under hand. Level flesh is a feature of all fattening stock of pronounced merit, and it is hardly necessary to say that it is as important in the Devon as in any other breed.

As a Show Beast.—As a show animal there are few equally attractive breeds. It is true that there is a tendency to uneven fleshing at the summer shows, perhaps still more apparent at the fat stock meetings, but this is due to the feeding as much as to anything else. A really well ripened Devon is remarkable for two things—plumpness and good killing qualities. In the smaller types so ripe are they that on parade they have a tendency to waddle like a well-fleshed duck, but that must be regarded as a tribute to their wonderful width and flesh-bearing qualities.

On the Farm.—On the farm Devons are kept either as grazers or feeders. Many of the south country feeders replenish their courts with Devon steers, which move off rapidly, enabling three batches a-year to be fitted for the butcher. At one time they were popular with eastern feeders in Norfolk and elsewhere, but as a rule the Norfolk beef-grower prefers an animal of greater scale.

The Milking Type.

Devon cattle are not devoted to beef production alone. There are milking strains which find much appreciation in Dorsetshire, where herds are kept for the express purpose of supply-milk for town consumption. It may be asked why keep Devons of a milking type when the Shorthorn is available? The reason is that when a breed becomes acclimatised and retains its ability to put on flesh when dry, its capacity to adapt itself to the locality is worth a good deal in size and substance. The milking type of Devon is a beautiful animal, with a good vessel and all the breed characteristics in form, character, and quality. Perhaps in some cases they are not quite such a deep red in colour, but their form and qualities are essentially dual purpose—milk and beef. Few particulars can be obtained of herd yields.

Devons in a Yorkshire Dairy.—Mr G. J. B. Chetwynd, who has established a herd near Doncaster, has a very high opinion of them for the purposes of a private dairy. He picked the best blood in Dorsetshire, and has some beautiful cows as his foundation stock. The chief points to be remembered in choosing a breed such as this are that it is capable of milking well and giving richly in quality. They have been so long bred on uniform lines that they throw their young stock very true, and when the calves are not wanted for milk purposes they fatten rapidly either for veal or young beef.

Mr Chetwynd considers the milking Devon one of *the* dairy breeds of the country. They are moderate eaters, and in return are rich milkers. In Mr Chetwynd's belief, if the breed had been run on milk records, classes would have been provided at the dairy shows. The milk testing in the Wyndthorpe herd is for butter-fat in carefully mixed samples. Each cow's milk is tested monthly, beginning one month from the date of calving. An extract from the results recorded in these tests is interesting, as the following will show:—

Date calving.	Date tested.	Quantity of Milk per day.	Per cent fat.
16th Dec.	16th Jan.	32.25 lb.	4.4
19th "	19th "	30 lb.	4.4
26th "	26th "	30.75 lb.	4

Another cow was giving 35 lb. of milk daily only three weeks off calving.

Classes have recently been established for milking Devons at the Bath and West shows, and doubtless as they become better known they will extend their radius of influence.

Antiquity of Milking Type.—The milking type is of course no product of the new century. It goes back more than a hundred years. In the year 1808 Vancouver mentions a cow which, three weeks after calving, yielded in seven successive days 17½ lb. of butter, averaging 14½ pints of milk daily. Another cow, Mr J. G. Davis's "Cherry," gave 2 lb. 5 oz. of butter from 33 pints of milk. Instances are on record of 2½ lb. of butter per cow being made daily from the rich milk of this breed.

Weights.—The popular London handy weight Devon is probably from 1 to 2 cwt. lighter than most of the larger breeds. It is a popular fallacy to assume that because the breed's reputation has chiefly been built up by the Devon of smaller scale, animals that weigh well cannot be found. At Smithfield Show in 1907 the heaviest Devon steer was

18 cwt. 12 lb., the age being 2 years 10 months 3 weeks. Steers under two years averaged 10 cwt. 3 qrs. 9 lb., while the class of major age varied in weight from 12 cwt. 24 lb. to 18 cwt. 12 lb. A good weight for fat show heifers is about 13 cwt., although from 1 to 1½ cwt. less is often recorded.

MANAGEMENT OF DEVONS.

The management of Devon herds may best be described in the words of breeders themselves.

Mr Chick's Herd.

Mr W. J. Chick of Stratton, Dorchester, who is an advocate of the milking Devon, says that the "dairies" in Dorset are let to dairymen at £11 to £12 per cow annually, the owner finding house and premises for the dairyman's use, and food for the cow.

When let, the calving season is during the months of January to April. "As a rule," says Mr Chick, "the cows first fat their calves, but those required for breeding purposes are taken from their dams at a week old and reared by hand on skim-milk. During the winter and spring the cows in milk stay in at night, and are fed on hay with some corn or cake, and by day run out on the pastures. During April or May the cows go on fresh pastures, and stay out at night, the cake and hay then being stopped.

"By this time most of the calves are fattened, there being a good supply of milk if the separator is not used. Best cheese or butter and blue cheese are made. The buttermilk and whey are given to the pigs. The cows are dried off about 22 weeks after service, are fed on straw in the yards, with a run out at pasture until they calve again.

"The best cows give from 40 to 50 lb. of milk per day, but not many in a herd will keep up this quantity. When managed as a letting-dairy, I have known a herd that made 180 lb. to 220 lb. butter per cow, the average being taken from 12 to 14 consecutive years. When the herds are managed by the owner, the milk, as a rule, is sold. Then the cows are calved from September to April."

Mr Huxtable's Herd.

Mr J. L. Huxtable of Overton, Bishops Tawton, writes: "The cow is generally dried off from six to eight weeks before being due to calve. She is put on not too rich pasture in summer. In winter she is fed on roots and oat-straw or hay. After calving, the food is usually light and digestible, such as bran and a few mangolds and a little hay for two or three days. A plentiful supply of water is at hand, the chill first being taken off. It has been my practice for 27 years to give a cleansing and cooling drench when necessary, and I have had only two bad cases of milk-fever, and both speedily recovered.

"Methods of rearing calves vary. Some run with the dams, and others are kept indoors and allowed to suckle the cow morning and evening. More generally, however, the calf is taken from the cow at from two to three weeks old, and fed on skim or separated milk with a little calf-meal mixed with it. Bruised oats, cake, hay, and roots are also given.

"In summer fattening, the cattle are put on pasture with an allowance of cake. In winter, they are either yarded or tied in stalls with an allowance of roots, hay, and cake or meal. Cattle not kept for breeding are fattened at from two to three years old, their weights varying according to age from 30 to 40 scores (of 20 lb. dead). I have sold one two years and eight months old for £25, about 44 score."

Mr Tribble's Herd.

Mr Abram Tribble of Halsdon, Holsworthy, North Devon, says that the heifers in calf generally run during the summer months on the moor-ground or common pasture-land attached to most farms, and are wintered in an open shed, where they are given hay night and morning, with free access to some old grass by day. The in-calf cows are generally milked to within six weeks to two months of calving, and during that time have ordinary rations; in winter, hay twice, roots twice, out during day, and perhaps a little crushed oats or pulped roots with chaff once.

"The method of rearing calves for the

commercial market is to wean after ten days old, and feed twice daily on separated milk, to which should be added a calf-meal or boiled linseed. They are given hay from the rick, and a little cake, crushed oats, and cut roots. When old enough to eat more the allowance of food is gradually increased. Wean off the separated milk at from three to four months. To rear bull calves for show purposes let them suck from three to five months old. The steers are usually sold at two years old for fattening and grazing up-country. Many go to Chichester from here. These usually make £15 at two years old. The cows and calves chiefly go to Exeter Cattle Market to supply the dairies around there, and the calves come back again and are reared here.

"Devon cattle are practically free from tuberculosis. I have never had an animal which has failed under the tuberculin test."

The portrait of a characteristic Devon bull is given in Plate 31.

SOUTH DEVON CATTLE.

The South Devon breed of cattle may best be described as the antithesis of the Devon. The "South Hams" or "Red Devons," as they have been variously called, have a lengthy and historical connection with the county.

Early History.—The early history of the breed has not been brought together into concrete form, but here and there in early literature of a purely agricultural character and otherwise it is referred to. Thus, in 1700, Prince in his *Worthies of Devon* singles out the breed as distinct from any other in England. It was then located between the Teign and the Tamar, being described as of great size, and peculiarly adapted for tilling the steep hills that are found in that neighbourhood. In these early days the largest calves were kept for stock purposes, the thick-backed, fleshy youngsters being sent into the veal market. The reason given for sending these latter calves to market so early was that they would not in all probability grow tall enough for the "collar" work, which was then an important part of the duties of the breed. It thus came about that size, which is to-day a distinguishing feature of the South Devon, was one of the earliest points cultivated by the breeder.

Old breeders refer to a famous ox, owned by Mr Toms of Coyton, Ivybridge, about the middle of the nineteenth century, which, when killed, weighed 16 cwt. He is said to have shown a fine carcase, thickly fleshed, with no waste. That was, of course, in the time of work-oxen. Mr William Treneman of Burraton also brought an ox to the block which weighed over 16 cwt. dressed. Other cases are recorded of oxen, without artificial food, scaling 14 cwt. in the carcase. It was only in the latter half of the nineteenth century, when the work of the farm was transferred to the horse, that the early maturing qualities of the breed were considered, and amongst the pioneers in this direction Mr John Wroth of Knowle deserves honourable mention.

The Herd-Book Society. — In the olden days it was the custom for farmers to breed from the same class of stock for generations. The stock-bulls were kept at farms perhaps two or three miles apart, and breeders drove their cows to these "custom places," as they were then termed. All this was altered by a period of depression and by the inroads of the Shorthorn in the "'fifties" of the last century. Consequently, to maintain purity in the best and smallest breeding-herds, a herd-book became a matter of necessity.

Locality.—The breed has not penetrated beyond the area of the south-western counties of England — Devon and Cornwall—but with the establishment of a herd-book it has certainly very effectually captured the farmers of the south-west, who, having tried Shorthorns, found them less satisfactory from a rent-paying point of view than the

South Devons. From Exeter to Lands End may therefore be considered the home of the breed.

Description.

No standard of points has been fixed by the Herd-Book Society. Those who have seen this breed at home on the fine pasture-lands of the south-west or in the showyard are never likely to forget their characteristics. The recognised colour is described by breeders somewhat indefinitely as a "medium red." The North Devon red and the type of curly coat found in that breed are two things which are strictly avoided, for there is not a little rivalry between the two breeds.

The "points of excellence" are thus described:—

"Rich medium red in colour, hide of moderate thickness, loose and mellow, well covered with soft curly hair, straight over the back and rump, deep and full in girth and full at the chest, shoulders covered at the points and flat on the top, bone of moderate size, tail commencing from line of back and hanging below the hock with a good brush, pins fairly wide but not very prominent, flanks deep, forming straight underline, full and deep in rounds, rump well filled and straight from peg to pin, ribs wide, deep, and well back to the pin, nose white and wide.

"**Bulls.**—The head massive and broad in the forehead, but not coarse, long from eyes to nose and well covered with curly hair, eyes wide apart, nose white and wide, horns white or yellow, wide at base, and tapering with downward tendency.

"**Females.**—The head broad and of medium length, eyes full, horns white or yellow, wide at base, tapering, and fairly straight, the udder well forward and projecting behind, not too fleshy, teats of fair size, regular, and well distributed."

Recent Improvement in the Breed.—These "points of excellence" somewhat inadequately describe the appearance of the South Devon. In the first place, it may be explained that the "South Ham" cattle are without doubt the largest and heaviest of our bovine races. The improvement that breeders have effected since about 1890 is marvellous. In the early days they were hard-fleshed cattle, if we judge them by the standards set up by other breeds. To-day they are big, wealthy, symmetrical animals of an eminently rent-paying kind. "No more sneering at symmetry," ssid a well-known breeder, and he was right. In the bulls there is immense sap and very thick flesh, with an evenness of fleshing which is altogether remarkable in animals of such great weight. Occasionally we meet with a lack of style, and sometimes an absence of quality, but the preference as exhibited in the showyard is undoubtedly towards quality, although those breeders whose ideas were nurtured on the older type of cattle needlessly deplore a distinct preference in that direction. There is sometimes a lack of second thigh and weakness of fore rib, but these defects are found in every breed. Certainly the most remarkable development in modern times has been in the way of thicker fleshing, greater symmetry, and more quality.

The cows are fine milkers, and a thousand gallons are not infrequently yielded in the course of the year.

The South Devons Abroad.—The breed has enlisted many supporters abroad. The fact that it is capable of imparting great size to the progeny is a strong point in its favour. South Africa, the Antipodes, Jamaica, and many other countries have been purchasers, and there is every appearance of a great development in this direction in the future.

Weights.—When dealing with the weights of this breed, reference must first be made to Mr W. J. Crossing's champion bull "Good Gift," which as a six-year-old turned the scale at 27½ cwt. Bulls of mature age not infrequently scale from 23 cwt. to 26 cwt. A good fat steer was "Jumbo," which won a fat show championship in the south-west of England for Mr W. M. Roberts of St Germans. He turned the beam at 22 cwt. 1 qr. 27 lb. As an illustration of rapid maturity and great weight for age, reference may be made to a young steer shown at Smithfield in 1894 by Mr J. Sparrow Wroth of Coombe, Aveton Gifford. This steer, aged 668 days, scaled 1833 lb., giving an average daily

gain of 2.74 lb. The weight of the dressed carcase was 1190 lb., and the average daily gain of carcase 1.78 lb. There were 120 lb. of loose fat and 112 lb. of hide. The butcher's report was altogether favourable to the quality of the flesh and the profitable nature of the carcase. The kidneys were remarkably fine; one of the "nobs" weighed 17 lb. cut straight across. Similarly, in the competition for the best carcase at the London Smithfield Show, the South Devon breed has on occasion won highest honours.

Milking Qualities.—In South Devon there are many cows which give 5 and 6 gallons daily in the full flow of milk. At the London Dairy Show in 1906 the cow "Iris," 150 days in milk, shown by Mr Cundy, yielded in twenty-four hours 63.15 lb. milk, from which 2 lb. ½ oz. of butter were made. The second cow, "Primrose," yielded 50.4 lb., 153 days in milk; and "Sally II." gave 48.1 lb., 136 days in milk.

MANAGEMENT OF SOUTH DEVONS.

The systems of management pursued in herds of South Devon cattle vary to some extent. They are usually natural and fairly liberal.

Mr W. J. Crossing's Herd.

In the herd of Mr W. J. Crossing of Woodford, Plympton, the calves are weaned from the cow at a week old and then reared by hand. No heifer is timed to calve under three years old, the object being to prevent a check in growth which seriously affects perfection in the cow. The herd numbers from 25 to 30 cows, and some of them yield from 20 to 24 quarts of milk daily, the average being about 12 quarts.

Each cow is kept in the herd till she produces about four calves, although some of them produce six or seven. For fattening cattle linseed-cake and a mixed cake are used at the rate of about 10 lb. daily, and in winter hay and roots are given in addition. The carcase weights would be from 7½ to 10 cwt., and in some cases more.

Food for the milking cows varies. Crushed oats, dairy meals, maize-meal, bran and cake mixed, are used. Mr Crossing adds, "The quality of the milk obtained is all that can be desired."

Messrs Whitley's Herd.

Messrs Whitley of Primley Farm, Paignton, Devon, keep their herd at grass throughout the summer, giving a small allowance of corn or cake once a-day when the cows are milking heavily. They supply a large quantity of milk and cream to the town of Paignton. The cattle are kept out in winter unless the weather is exceptionally severe. Thus, in the winter of 1907-8, the cows were taken in only on six nights.

The food consists of hay, roots, corn, or cake. The best cows will average about 20 quarts of milk daily. The calves are taken from the cows at a week old and fed on scalded milk and linseed until they are old enough to pick up a living for themselves, when they go out to graze.

The steers are fattened for beef at about two to two and a half years old, and generally realise from £18 to £28, 10s., the live-weight being from 12 to 16 cwt. Messrs Whitley add, "We have had a steer at two years and eleven months old weigh 19 cwt. and make £41, its dead-weight in beef being 12 cwt. 3 qrs. 6 lb."

The best heifers at Primley are kept for breeding purposes. At seven or eight years old the cows are fattened off, selling at from £20 to £30.

The bulls grow to an enormous size, some weighing up to 30 cwt. "We measured one of ours the other day in reference to an inquiry we received," write Messrs Whitley, "and the following are the particulars:—

Height at shoulders . .	5 ft. 1 in.
Height at croup	5 ,, 1 ,,
Length of body from top of shoulder to root of tail . . .	5 ,, 4 ,,
Length of neck from top of shoulder to centre of horns .	2 ,, 7 ,,
Girth behind shoulder . . .	7 ,, 6 ,,

Mr B. Luscombe's Herd.

Mr B. Luscombe of South Langston, Kingston, Kingsbridge, does not sell milk, but makes use of the separated milk on his farm for feeding calves. He adds a little cake and crushed corn for this purpose as soon as the calves are

old enough to take it. His cows have yielded up to 7 gallons daily. Animals intended for exhibition are allowed the use of a courtyard with a shed. They are fed in the shed on roots, hay, corn, and cake. Mr Luscombe adds: "The live-weight of beasts in this neighbourhood runs from 14 to 18 cwt. by the time they are ripe for slaughter; but in many cases they turn the scale at a ton. Some of the heaviest are from 24 to 26 cwt."

Messrs Butland's Herd.

Messrs Butland Brothers of Leigham, Plympton, milk about 50 cows and send the milk to Plymouth. They average from 2 to 3 gallons per head daily, and that includes cows that are getting on in calf. "The largest quantity," Mr B. Butland writes, "I ever knew a South Devon to give in one day was 32 quarts, but we have several that will give from 20 to 25 quarts per day." The cattle are out by day in winter, and have turnips in the field. By night they are under cover, and have mangels, crushed oats, dairy meal, maize meal, bran, and a little linseed-cake. In summer a little cotton-cake with linseed and bran is fed. The general weight of fat beasts is from 8 to 12 cwt. "We rear our own calves by the stall cows," adds Mr Butland. "We cannot allow them more than 2 to 3 quarts of milk per day, but we get them to take a little linseed-cake as soon as possible."

In Plate 32 a portrait is given of a typical South Devon bull.

SUSSEX CATTLE.

The Sussex breed is one of the old indigenous varieties of cattle. It has remained, so far as England is concerned, a purely local breed.

History.—The history of the breed has been comparatively uneventful. It has come through no sensational periods, either in the show or sale-ring, but breeders can point to a record of solid useful work. As far back as 1795, Arthur Young, writing in the *Annals of Agriculture*, declared that the Sussex cattle were recognised as a well-established breed of high repute. He refers to an experiment in feeding which proves the cattle at that time to have shown a tendency to very early development. He sums up their merits thus: "Sussex oxen are as remarkable for the fineness of their hides as they are for the closeness and delicacy of their flesh."

Early Aims.—One of the chief objects of breeders in the early days was to breed Sussex oxen for the plough. They were largely used for multifarious draught purposes. They were able, owing to their wonderful size and weight, to move heavy loads, and on account of their steady pull they made few breakages. Probably the local demand for oxen for this purpose did not suggest to breeders a wider market than the mere slavish work of the farm and estate. But it is not too much to say that they thereby laid the foundation of a magnificent constitution, which has been inherited by the modern representatives of the breed.

Locality.—To-day the red-coated Sussex cattle are found on the wealden clays of Sussex, Kent, and Surrey. These counties comprise all qualities of grazing land, poor, thin soil, and stiff clays. On the poor lands the breed was at one time raised, and finished off for the butcher on the stronger lands. There are few herds outside of the counties of its birth.

Standard Description.

It was as far back as 1855 that the *Sussex Herd-book* was established. During the period of its existence it has witnessed a radical alteration in the type of the breed and the objects which the breeder has in view. The work-ox has all but gone, and in his place has come the early maturing steer. The following is the standard of excellence as adopted by a general meeting of members of the Sussex Herd-book Society in 1907:—

Bulls.

Registered pedigree.
Head.—Masculine and fairly long.
Forehead.—Broad.
Eyes.—Bold.
Ears.—Of medium size and thickness, fringed with fine hair, and clear flesh-coloured inside.
Nose.—Broad, flesh-coloured, and free from dark spots.
Horns.—Clear, not coarse, starting at right angles to the head and slightly curved inwards, with dark tips.
Throat.—Clean.
Neck.—Muscular and of medium length, spreading out to meet the shoulders, which should not be coarse but neat; sloping, well covered, and showing no projection at the point when looked at from the front.
Chest.—Broad and deep.
Back.—Straight, not rising above the top of the shoulders, and level thence to the setting on of the tail.
Loins.—Broad and full.
Hips.—Moderately wide and on a level with the back.
Ribs.—Well sprung and nicely arched.
Rumps.—Full and level.
Hind Quarters.—Deep, thick, and square.
Tail.—Set in the back, level with the top line, and hanging at right angles to the back; to be of medium thickness, showing strength but no coarseness.
Underline.—To be as nearly as possible parallel with the top line.
Arms and Thighs.—Muscular.
Legs.—Short, good quality bone, with flat, strong, clean hocks, and to be squarely placed when viewed behind.
Flesh.—Even.
Skin.—Moderately thick, mellow to the touch, and covered with an abundant coat of rich, soft, red hair (preferably dark); a little white in front of the purse is admissible but not desirable, and must not extend beyond the navel or appear on any other part of the animal, but a few grey hairs are no disqualification.
General Appearance.—Masculine and active.

Cows.

Registered pedigree.
Head.—Feminine character, moderately long.
Forehead.—Broad.
Eyes.—Bright and prominent.
Ears.—Thin, fringed with fine hair, and clear flesh-coloured inside.
Nose.—Broad, flesh-coloured, and free from dark spots.
Horns.—Clear, not coarse, starting at right angles to the head, well balanced and spreading, with an even, graceful curve slightly upwards, with dark tips.
Throat.—Clean.
Neck.—Of medium length.
Shoulders.—Not coarse but neat and sloping and well covered, showing no projection at the point when looked at from the front.
Chest.—Broad and deep.
Back.—Straight, not rising above the top of the shoulders, and level thence to the setting on of the tail.
Loins.—Broad and full.
Hips.—Moderately wide and on a level with the back.
Ribs.—Well sprung and nicely arched.
Rumps.—Full and level.
Hind Quarters.—Deep, thick, and square.
Udder.—Square, not fleshy, teats set evenly apart.
Tail.—Set in the back, level with the top line, hanging at right angles to the back, and to be of medium thickness.
Underline.—To be as nearly as possible parallel with top line.
Legs.—Short, good quality bone with flat, strong, clean hocks, and to be squarely placed when viewed behind.
Flesh.—Even.
Skin.—Moderately thin, and mellow to the touch, and covered with an abundant coat of rich, soft, red hair (preferably dark); a little white about the udder is admissible but not desirable, and must not extend beyond the navel or appear on any other part of the animal, but a few grey hairs are not a disqualification.
General Appearance.—Smart and gay.

There is nothing to add to the above description, which accurately paints the type of Sussex animal which breeders are aiming to produce. The most common fault of the breed is a shortness of second thigh, more accurately described as "hamminess." The breed is very even in flesh, and is deeply fleshed over the back and ribs.

Weights and Early Maturity.—The weights to which the breed grow are clear and convincing evidence of successful breeding for early maturity. Perhaps this is best exemplified by an examination of the Smithfield Show cattle for a number of years. Over a consecutive period of eight years the class of steers under two years of age has averaged 678 days old and 1422 lb. weight, equivalent to an average daily gain of 2 lb. 1.55 oz. Taking the heaviest beast each year, they averaged over eight years a daily gain of 2 lb. 8¾ oz., while the average of the lowest in the class was 1 lb. 12.90 oz. In the two-year-old class over eight years the average age was 1024 days, and the average daily gain 1 lb. 11.93 oz. The

best steer each year averaged a daily gain of 2 lb. 2.28 oz., which must be considered a remarkable tribute to the early maturing propensities of the Sussex cattle. The heifers averaged 2 lb. 2.02 oz. for the best in eight successive years, while the class average was 1 lb. 10.72 oz. daily. It is worthy of special note that the fine young steer which made the highest gain in 1902—viz., 2 lb. 8.34 oz.—killed 68.02 per cent carcase. The highest known yield of carcase to live-weight was recorded in 1888, when a steer weighing 1422 lb. killed 71.67 per cent.

Sussex Bulls for Crossing. — In many ways the Sussex bull might with profit be more widely used for cross-breeding purposes. In 1900 two crosses were exhibited at the Smithfield Show, but a third prize was the highest prize won, although the carcases were very meaty. In 1899 a first prize was won with a heifer.

Sussex Cattle Abroad.—The breed should be very useful in those countries where a draught type of ox is required. A number have been taken to Egypt. In America the breed is appreciated. One purchaser in Tennessee, who has supported the Sussex breed for many years, declares that "the introduction of the Sussex breed has proved an unqualified success, and the breed has stood the crucial test of yielding a reasonable return over the cost of production. . . . The domiciliation of the Sussex in this country is an accomplished fact, and in Tennessee, its peculiar *habitat*, is doing its full share in the improvement of native cattle."

MANAGEMENT OF SUSSEX CATTLE.

There is little specially to record as peculiar to the management of Sussex herds. Mr A. Heasman says that the most successful way of breeding is to calve the cows down in October and November, to let them have their own calf through the winter, weaning in spring, and thereupon putting another calf to the cow. By this method one cow rears two calves. It may be added that the Sussex cow is only a moderate milker, the chief use of the breed being beef-production.

Lord Winterton's Herd.

Mr W. Massie, agent to Earl Winterton, says: "We find the best results are obtained from calves dropped as early as possible in January. The calves are allowed to run with their mothers during the summer months, one cow sometimes bringing up two calves. The average time of suckling is nine months. The cattle are usually wintered in open or covered courts, their feeding consisting of crushed oats mixed with roots and hay. In the following summer they are fattened off the grass with the assistance of linseed- and cotton-cake, and are all sold to the butcher before they are twenty months old. The best average price I have been able to make under these conditions is £24, 8s. for fourteen head sold during summer."

With regard to weights of commercial animals, Mr Massie adds: "We frequently get them to weigh from 100 to 110 stones (14 lb.) per bullock at twenty months old, which at the present price of 4s. 10d. in Guildford market would be £24, 3s. 4d. for the 100 stones. I find that I can generally get from 2d. to 4d. per stone more for them than for cross-breds."

Mr Steven Agate's Herd.

Mr Steven Agate of Horsham usually lets the calves run with the cows until October. They are then weaned and put on rations so as not to lose the calf-flesh. They are fed according to their requirements, some doing so much better than others. Mr Agate generally makes his beasts fit for the butcher at two years old, weighing then between 90 and 100 stones.

The cows are run in the yards during winter, before calving, and have a little hay but no roots. After calving they get what meal and roots they can clear up, as the better the cow does the more satisfactory is the calf's progress. Mr Agate believes in plenty of exercise for all stock, keeping them as clean and comfortable as possible, and, in the matter of feeding, giving salt with their chaff and roots.

Mr Hubble's Herd.

Mr H. T. Hubble of Maidstone owns a half Sussex, half Aberdeen-Angus

herd. His method of rearing is to allow the calves to run with the cows in the meadow until the autumn, and then separate the steer calves from the heifers, giving them meal, cake, and hay, and, following the old plan, giving a few swedes in the mid-day ration. Mr Hubble says: "I find a cross with an Aberdeen-Angus bull on the Sussex cow produces good quality of beef. I have this year taken some first and second prizes with this cross, and sold them for £27, £28, and £30 at 20 and 21 months old."

In Plate 33 a portrait is given of a well-known Sussex cow.

AYRSHIRE CATTLE.

The Ayrshire breed of cattle affords a striking example of how the farmers of Great Britain have in years past gradually developed classes of live stock to suit the physical features of each distinctive district of the country. The breed is native to the poorer arable land of Ayrshire, Renfrew, and Lanark. There the farms have always been small, and the surrounding circumstances were such as to point to dairying in preference to the raising of store stock or the production of beef. Of necessity, the cows had to be small in size and hardy of constitution. Before draining became general and artificial manure was available, the Ayrshire had no land of Goshen to enjoy life in, and clearly the breed was evolved long before the advent of either of these aids to the advancement of agriculture.

Historical.—The breed must have originated in the local cattle of the district referred to. What these were no one can tell with any degree of confidence. There is, however, fairly conclusive evidence that for at least a hundred years the Ayrshire cow has not varied much in character.

Early Ideals.—In the minute-book of the Kilmarnock Farmers' Club there is a report, dated 7th August 1795, of a discussion opened by Gilbert Burns (brother of Robert) on "What may be further done to improve the cattle in this country." The summing up of that paper ran thus: "That although much has been done of late in this country in selecting proper individuals of the species to breed from, yet much remains to be done. That particular attention ought to be given to the whole form of the animal as well as to its colour and horns. That much attention also ought to be given in the selection of the cow as well as of the bull. That young cattle, while in a growing state, ought to be more liberally fed than they too generally are in this country; and that as great a proportion of succulent food as possible ought to be given them in winter while they are calves, and thereafter plenty of rye-grass hay each spring."

Something more specific than these generalities was forthcoming at a discussion held shortly thereafter on "The particular form of cattle the Ayrshire farmer ought to select to breed from." The result of this discussion is thus summed up in the minute: "Long and small in the snout, small horns, small neck, clean and light in the chops and dewlap, short-legged, large in the hind quarters, straight and full in the back, broad above the kidneys and at the knuckle bones, broad and wide in the thigh, but not thick-hipped, a thin soft skin of the fashionable colours, whatever these be, and the mother carrying her milk pretty high and well forward on the belly." It would seem that this description is intended to apply to both the male and female form.

Points of the Breed.

In 1884 it was submitted to a committee of the Ayrshire Agricultural Association "to revise the points indicating excellence in the Ayrshire breed of cattle, and to consider other matters connected therewith." The following is the finding of this committee:—

	Points.
1. Head short, forehead wide, nose fine between the muzzle and eyes, muzzle large, eyes full and lively, horns wide set on, inclining upwards	10
2. Neck moderately long, and straight from the head to the top of the shoulder, free from loose skin on the under side, fine at its junction with the head, and enlarging symmetrically towards the shoulders .	5
3. Fore quarters—shoulders sloping, withers fine, chest sufficiently broad and deep to ensure constitution, brisket and whole fore quarters light, the cow gradually increasing in depth and width backwards . . .	5
4. Back short and straight, spine well defined, especially at the shoulders; short ribs arched, the body deep at the flanks	10
5. Hind quarters long, broad, and straight; hook bones wide apart, and not overlaid with fat; thighs deep and broad; tail long, slender, and set on level with the back . . .	8
6. Udder capacious and not fleshy, hinder part broad and firmly attached to the body, the sole nearly level and extending well forward, milk veins about udder and abdomen well developed. The teats from 2 to 2½ inches in length, equal in thickness, the thickness being in proportion to the length, hanging perpendicularly; their distance apart, *at the sides*, should be equal to about one-third of the length of the vessel, and across to about one-half of the breadth	33
7. Legs short in proportion to size, the bones fine, the joints firm . .	3
8. Skin soft and elastic, and covered with soft, close, woolly hair . . .	5
9. Colour, red,—of any shade, brown or white, or a *mixture* of these, each colour being distinctly defined. Brindle or black and white is not in favour	3
10. Average live-weight, in full milk, about 10½ cwt.	8
11. General appearance, including style and movement	10
Perfection .	100

There is a later pronouncement than this on the part of a committee appointed by the Ayrshire Cattle Herd-Book Society and adopted by the latter in 1906. Though much the same in effect as the Agricultural Association's schedule, it is hardly so much to the point. The Herd-Book Society devote a separate schedule to the bull. The Society's schedule allows for the udder maximum marks of 20 compared with the 33 set aside by the Association; and the desirable size for teats is "2½ to 3½ inches, and not less than 2 inches." Under head of colour brindle alone is stamped as undesirable. "Black and white" passes. Escutcheon gets 1 (in the case of the bull this is stretched to 4). Weight gets 4 only, but the newer schedule standardises the weight of the cow at maturity from 800 to 1000 lb. This we suspect is nearer the mark than the 10½ cwt. stated above. And the increase in length of the teats in the later schedule indicates the recent breaking away from the smallness of teat which fashion unfortunately upheld in the closing quarter of last century.

Type Similar for 100 Years.—There seems, as we have said, to be little difference between the ideal Ayrshire of to-day and that of over a hundred years past. In little, indeed, except as regards horns is there any real difference. A hundred years ago the Ayrshire cow, as old engravings show, had smaller horns than now, and they curled inwards on the forehead instead of standing out wide apart and pointing upwards as on present-day cows. Colour does not seem to carry many marks with it. Even the Kilmarnock experts of a century ago allowed this point to be ruled by fleeting fashion. At present, judging from the cattle one sees at shows, it would appear that the breed will ere long be colourless. The majority of these are white, with a splash here and there of red.

In the fields, however, the rank and file of the breed are considerably diversified in this respect, as one would expect from the terms of the foregoing schedule. Black, though slightly unpopular in the judging ring, is by no means uncommon in the field. But in common with the recognised red and brown overlays the patches thereof are unmixed. Black is indeed understood to be the original ground of the Ayrshire's coat, and at Ayr show there has been of late a special class for animals with black markings.

In this connection it may be noted that the nondescript cattle of the district (those which, unlike the Ayrshire, the West Highlander, and the Galloway,

had never been differentiated from the common herd, but had drifted on in accordance with casual circumstances) are spoken of in the minute-book above referred to as black cattle, to distinguish them from the Ayrshires proper.

Infusion of Strange Blood.—There are instances on record towards the end of the eighteenth century and the beginning of the nineteenth of Shorthorn blood having been introduced into the Ayrshire strain. Dutch or Holstein blood is said by some of the writers on agricultural subjects about that time to have been used too. But it would appear that in both cases this new streamlet soon became toned down and lost in the general current. As regards the Shorthorn breed, however, this may have brought the change of colour which distinguishes the modern from the old Ayrshire. Otherwise, the Ayrshire has little in common with the Shorthorn. And, luckily, the Dutch or Holstein dash of blood has not interfered with the established graceful lines of the Scottish breed of dairy cattle, however it may have helped to improve their milking powers.

Useful Properties.

Milking Properties All-important.—The regrettable custom of recent years of judging Ayrshire cows solely on their physical points, giving as much as 33 per cent of total points for a well-turned udder, without the slightest reference to the most important matter of all in the why and wherefore of the existence of the cow, has begun to be understood by the practical farmer, and he is looking around for a remedy. This is not so easily found, however, although the Highland and Agricultural Society is seeking to give a lead in this respect which is now being accepted by the Herd-Book Society of the breed.

Milk Records.—In 1903 the Highland and Agricultural Society began a movement with the object of inducing owners of dairy herds to keep careful records of the quantity and quality of milk given by each cow, it being recognised by that Society that only by such means can even the most experienced man obtain reliable knowledge of the milking qualities of his stock. The National Society instituted local societies in several districts to conduct the keeping of records, and the work gained so rapidly in favour with dairy farmers that in 1908 the direction of the movement was taken over by the Ayrshire Cattle Herd-Book Society. In the year 1908 records were kept in thirteen centres, embracing over 8000 cows.

Value of Milk Records.—Although the points of the Ayrshire cow are on the lines clearly indicative of high milking power, an animal may approach very closely upon excellence, as defined by the schedule, and yet be poor in contributing to the milk-pail. But with the advent of record-keeping there is less chance of this state of matters occurring often. The symmetrical cow is at any time of more value than the comparatively unsightly one. When, however, in addition, the former can show a good record that can be relied upon, her value is increased considerably. And the same, of course, applies to a cow less pleasant to look upon. A good-service testimonial of the kind will always make such a cow easy to sell.

Care will, however, need to be taken that the Ayrshire cow is not unduly pressed in this connection. There is a limit of her milk-yielding powers beyond which it is unwise to seek to press her if we wish to maintain her present desirable stamina. There is room and to spare in raising the average by equalising (levelling up rather) as far as we can the individuals of the herd. It would not be wise to endeavour to build up a herd of "freak" milkers altogether; but the average will stand considerable augmentation without approaching the "freak" stage.

Milk Yields.—In many Ayrshire herds the annual average yield of milk does not much exceed 550 gallons. But gradually, as a result of selection in breeding and greater liberality in feeding, the yield is being increased, and there are now a large number of herds that substantially surpass 600 gallons on an average. Individual cows often yield from 750 to 1000 gallons, and in the milk records conducted by the Highland and Agricultural Society there are several yields between 1000 and 1200 gallons. Ayrshire milk is of medium quality.

Beef-Production.—Ayrshires are not famed as beef-producers. Animals of the breed have not the right kind of frame for the accumulation of beef. Irrespective of this, however, individuals of the breed seldom get the chance of showing what they can do in this respect. Generally speaking, only the bulls are rounded off in body in readiness for the butcher. The bulls have served their turn earlier in life than the cows; after three years' service the best of them are face to face with their own offspring, and a change must be made. A well-fed bull of the age this implies affords at the best but third-rate beef. The younger representatives are hardly so coarse. As a rule, moreover, the cast bulls are fed off in a somewhat haphazard manner.

The cows are seldom specially prepared for the butcher. They are kept pretty scraggy as milk-suppliers, and when they show signs of permanent failure in this respect they are passed on for slaughter as they stand. Youngish ones may pass muster in a way in the shambles; but the sinewy matrons can hardly be otherwise disposed of than in the mincing-machine. And when we add that the calves over and above the number required for stock purpose are slaughtered almost as soon as dropped, it will be allowed that the Ayrshire breed of cattle does not directly contribute much to the meat-supply of the country, and what it does contribute is, on the whole, of a poor description.

The Ayrshire is in her sphere matchless as a milk-supplier; she may be excused, therefore, in failing to do much as a beef-producer. Now and again it is suggested that the type so admirable of its kind should be modified so as to increase the bulk and square up the frame of the Ayrshire, and in this way get more beef on the carcase. It is doubtful, however, if it would be prudent to attempt much in this direction.

Weights.—Cattle of the Ayrshire breed attain moderate weights. For cows, when full-grown and in good milking condition, common live-weights are 8 or 9 cwt., some exceeding 10 cwt. Bulls run from 11½ to 14 cwt., fat bullocks about 11 to 12½ cwt., and heifers about 1 cwt. less.

MANAGEMENT OF AYRSHIRE HERDS.

The management of herds of Ayrshire cattle varies not only with the character of the districts in which they are kept, but also according to the purposes for which the milk of the cows is utilised. In many herds the main object is the selling of fresh milk in Glasgow and other centres of consumption; in others, cheese-making is the mainstay; in others, again, it is partly butter-making and partly cheese-making; while some dairy-farmers engage to a certain extent in all three methods. Obviously, the seasons for calving, methods of feeding, and general treatment must be varied to suit the peculiarities of these different systems of turning milk into hard cash.

Housing Cattle.—The general custom is to tie up cows in houses throughout the winter, taking them in when the grass fails and the weather gets cold in the autumn, and letting them out again in the late spring when grass is available. In most cases the cows get out for a time every day when the weather permits. All through the grazing season cows are usually kept on pasture.

Calving Season.—Where the main object is the selling of fresh milk, the great aim is to have calves dropped so that the supply of milk may be as nearly as possible equal in quantity throughout the year. In cheese-making and butter-making herds calves are mostly dropped early in spring, so that the cows may be in full milk throughout the grazing season.

Feeding in Milk-selling Herds.—In milk-selling herds the system of feeding must be liberal, and costly feeding-stuffs must be used to a considerable extent. In the grazing season the cows, as a rule, go to the pasture fields daily, and as additional food they may get moist mixtures of distillers' grains and meals. In summer the allowance of concentrated food varies from about 4 to 7 lb. each per day, the quantity varying with the supply of grass, and is generally increased as autumn approaches. In many cases the cows get a small quantity of freshly cut grass—about 20 to 25 lb—per day during the summer, in addition to what they eat in the fields.

In winter the allowance of grains and

meals is substantially increased, in some cases reaching about 10 or 12 lb. of grains and 6 or 8 lb. of meals per day. The meals usually consist most largely of the meal of beans, peas, or Indian corn, but they vary according to market prices. In addition, the cows get hay, oat-straw, and turnips or cabbages, and in some cases mangels in succession. The quantities of these allowed varies greatly in different herds, common allowances being 8 to 10 lb. of hay, 5 to 7 lb. of straw, and 25 to 35 lb. of roots.

In other cases in winter less is given in the way of grains, and the daily quantity of meals (including bruised oats) is raised somewhat, probably to 10 or 12 lb. per head. Bran is also used, and so is treacle, the latter at the rate of 1 or 1½ lb. per day.

On a good many farms the practice of giving turnips or other roots to dairy cows has been abandoned. In these cases quite the maximum quantities of concentrated foods mentioned are given.

As would be expected, these systems of feeding pursued on milk-selling farms entail heavy outlays. For the full year's keep the cost per cow cannot be much under £11 to £12. For the winter months it may cost about 1s. per day.

Feeding in Cheese- and Butter-making Herds.—In herds where the main objects are the making of cheese and butter the cows can usually be kept through the winter at less expense than in milk-selling herds. In the former herds most of the cows are wholly or partially dry in part of the winter season, and in that condition they are fed quite sparingly. If giving milk in winter, these cows are fed similarly to those in milk-selling herds, the daily allowance of concentrated food being perhaps rather smaller.

In the grazing season cows in cheese- and butter-making herds often get little in the way of extra food unless grass is deficient, but as autumn advances concentrated food is given in gradually increasing quantities, beginning with perhaps not more than 1 lb. per day.

Stewartry Customs.—In the counties of Kirkcudbright and Wigtown, where large quantities of turnips are grown, and where cheese-making is the main object with dairy farmers, the system of feeding pursued has its own peculiarities. There turnips enter largely into the dietary of the cows. Indeed it is in many cases calculated that there ought to be from 5 to 7 tons of turnips available for every cow in the herd.

In the early part of the winter season the cows in these Stewartry cheese-making herds get little or nothing but turnips and straw. In spring, after calving, the cows get a mixture of dried grains and cotton-seed meal or some other meal, at the rate of from 4 to 6 lb. per day. This mixture is most likely made into a sloppy condition by hot water, and it is given to the cows in a warm state. Oat-straw is given in moderate quantity—about 12 to 16 lb. —also turnips at the rate of from 50 to 80 lb. per day. In summer in these herds cows generally live entirely on pasture. The cost of keeping a cow for a year in cheese-making herds is estimated at from £8 to about £10, 10s.

Calves.—A large proportion of Ayrshire calves are sold soon after birth to be consumed as veal. Those that are reared usually get fresh whole-milk for a few weeks, skimmed-milk or butter-milk being gradually substituted. When the calves are about 8 to 10 weeks old gruel made of oatmeal and linseed is added to the milk, and they are taught to eat broken linseed or other cake. If still in the house, the calves get a little hay, and when the grass is ready and the weather favourable they go to the pastures.

Heifers.—During the grazing season heifers are kept entirely on pasture. In winter, in the colder parts, they are housed most of the time, getting turnips and straw, or instead of roots hay, and a small allowance—not over 2 lb. per day—of such foods as meals, cake, and bruised oats.

Boiled Food.—The practice of giving boiled food to cows was at one time largely followed in Ayrshire herds, but it has lost favour in most parts. The more general custom is to have the concentrated foods scaled with hot water, and fed when slightly warm.

The "Bowing" System.—Under what is known as the "Bowing" system the farmer lets his cows to a "Bower" at a rent of from about £12 to £15

a-year per cow, the farmer replacing any cow whose yield of milk falls below a standard agreed upon. The farmer provides house accommodation and all food for the cows, certain quantities of meals, &c., being stipulated for. The "Bower" milks the cows, and disposes of the milk to his own advantage. It is mainly Ayrshire cows that are kept under this system.

A characteristic cow of the Ayrshire breed is represented in Plate 42.

HIGHLAND CATTLE.

This singularly handsome breed of cattle, often spoken of as the "Kyloe," has its headquarters in the Western Islands of Scotland and on the high-lying grazing farms of the counties of Argyll, Perth, and Inverness. Amongst all the varieties of British cattle there is none more striking in appearance than the typical Highlander. It is quite as handsome in form as the most improved Shorthorn, is almost as large in size, and with its long shaggy coat of hair, wide-spreading, gracefully-turned horns, hardy muscular appearance, and defiant gait, throws all other varieties of cattle into the shade in picturesque beauty.

Origin.—The prevailing opinion as to the origin of Highland cattle is that they are descended, and that in a direct line, from the ancient native cattle of the districts still regarded as the home of the breed. Indeed it is generally considered that the wild white cattle of Chillingham, the wild cattle of Hamilton Park, the useful little Kerry of Ireland, and the Highland cattle of Scotland, are the purest representatives that we now have of the ancient cattle of the British Isles.

In the early days of the breed—and to this is no doubt due the fact that many people still put West before their name—there appears to have been two classes of Highland cattle. There was the West Highlander, which was largely an Island race, and the ordinary Highlander, which was more a mainland breed. The latter being kept, as a rule, on better fare than the Island cattle, were usually bigger in frame, although the Island cattle had the advantage in the matter of hair. But although there was this distinction at one time, it has long since disappeared. So far as both the name and general position of the breed are concerned, Highland cattle have for many years been Highland cattle wherever they have been bred. The breed society is called the Highland Cattle Society, and all cattle coming within its purview are judged by one standard of points.

The term "Kyloe," as applied to the breed, is believed by many to be simply an adaptation of the word kyloes or ferries which separate the Western Isles from the mainland of Scotland. This fits in with the theory that the name was first applied to Island cattle. On the other hand, some maintain that the name is a corruption of the Gaelic word which signifies "Highland," and if this be its proper derivation the term would, of course, lose significance.

Characteristics.

The outstanding characteristics of Highland cattle are their wonderful hardiness and their ability to adapt themselves to varying conditions. Mr Andrew S. Grant, to whom we are indebted for information on this and other breeds, states that Highland cattle can live and do well in altitudes and climatic conditions in which few other varieties of cattle would survive. Taken, on the other hand, to the richer pastures of the low grounds, they will yield almost as good a return for their keep as any other class of stock. Nothing sells better than a well-fleshed steer of the Highland breed, and for many years they have been in excellent demand for stocking gentlemen's parks and purposes of that sort.

Coat and Colour.—Owing to the comparatively hard conditions under which they have to exist in their native districts, a first essential in a

Highlander is a good thick although soft skin, and a good coat of hair. Hair is of importance, not only for keeping the animal warm but for throwing off moisture, of which it is hardly necessary to say the Western Highlands have always a full share. The coat, as in the case of a Blackface sheep, should be of the jacket and vest order—that is, there should be long but not too dense outergrowth and a short close covering next the skin. The outer hair should always be of fair strength, but free from harshness and dryness. The colour of the coat is not of so much importance, although, as a rule, it is easier to get the strength of hair required in a dark-coloured animal than in a very light-coloured one. In the early days of the breed wholly black animals were much run upon as being believed to be hardiest. Indeed, there is a tradition that almost the whole of the Island cattle were originally black, and that the lighter-coloured sorts came for most part from the mainland, and Perthshire in particular. Even yet, notwithstanding a slight tendency to harshness of hair on the part of many of them, some people still have a favour for blacks, although the majority of the cattle that one sees nowadays are either brindled, red, yellow, or dun. Very light yellows are rather apt to be associated with soft woolly hair; but apart from that no objection can be taken to them, as they frequently make good feeders and the cows capital milkers. In the case of bullocks, red is possibly the most popular colour, while as to bulls there seems to be a preference for brindles, with here and there a few reds and occasionally yellows.

Points of the Breed.

It cannot be said that the points of Highland cattle, apart from hair and horns, differ greatly from those of most other beef-breeds. The back should be straight and wide and the quarters well carried down to the hock. This latter is, and always has been, a point of great importance with Highlanders. It is believed to have been their fine quarters, combined with their excellent coats of hair, that first attracted the attention of the late Mr Thomas Bates to them as a possible source of improving material when he was building up his noted strains of Shorthorns. In late years some people have seen a tendency to neglect length and depth of quarter in favour of some other points, although it can be said with truth that good quarters are still a strong feature of the Highland breed.

The legs, both before and behind, should be short and strong, the bones strong, broad, and straight, the hoofs well set in and large, and the legs well feathered with hair. The importance of a good hoof, especially in a bull, should be emphasised; many people will not buy an animal that is not well equipped in this respect, as they hold that it is one of the surest indications of stamina and constitution. The hind legs should be hooked a little rather than straight up and down. The underline should be as straight with the back as possible, and both this and the thighs should be well covered with hair.

In olden days Highland breeders liked their cows to be wide between the hookbones. This is still a sign of a good, robust animal, although it should not be overdone, extra wide hooks being frequently associated with bareness over the loins. The head should be short and broad in front rather than narrow, the brow being covered with a long fringe of hair hanging over the eyes and without curls in it. The eyes should be prominent and clear—even to the extent of having a slight "staring" appearance when the animal is at attention.

In both the bull and the cow the horns are important, not only as enhancing the appearance of the animal but as an indication of breeding and constitution. They should be wide apart at the roots and show mellowness and "sap" to the points. A clear, hard, "shiny" horn is apt to be associated with slow-feeding qualities. Black-tipped horns are not liked except in black and dun animals. In the case of a brindle it is always a recommendation to have a waxy-yellow tinge right out to the end of the horns. As to the carriage of the horns, they should in the case of the bull come level out of the head, slightly inclining forwards, and also slightly rising towards the points. Some do not care for this rise, though any drooping is considered to be a very

bad fault when between the crown and the commencement of the curve. On the other hand, when the horns rise directly from the crown they detract from the appearance of the animal.

Two styles of horns are commonly seen in cows. In the first case they come squarer out from the head than in the male, rise sooner, and are somewhat longer, though they preserve their substance and reddish-yellow appearance to the very tips. The other taste is for horns coming more level from the head, with a peculiar back-set curve and very wide sweep. A large number of breeders prefer the latter style, which gives possibly the more graceful appearance.

An old fault in Highlanders is a tendency to flatness on the fore rib. The ribs should spring well out from the backbone, and should not only be rounded but deep. In the bull the neck should be of fair length and nicely arched, with a fringe of long hair hanging from the top.

Finally, the animal should be wide-set between the fore legs, and should move with great dignity and style, the movement of a Highlander being of great importance as an index of true and careful breeding.

Early Improvement.

Although the Highland breed never had its Bakewell or its Watson or M'Combie, it still had its own crop of distinguished early improvers. Amongst the earliest that are known to history were the Macneils of Barra and the Macdonalds of Balranald, families that are known to have had large folds[1] in the Long Island from time immemorial. Although the former fold was dispersed when the last Macneil sold his property, the produce of many of his cattle were, up to a comparatively recent date, to be found in the Long Island. The Balranald fold is still as extensive as ever, and has had a widespread influence for good, especially in the Islands.

Other great early improvers were the brothers Donald and Archibald Stewart, who went from Garth, in Perthshire, about the beginning of last century, to the farm of Luskentyre, in Harris. These gentlemen started a fold which, from the care bestowed upon it, and the skilful selection of bulls from the leading folds in Perthshire, soon became known as one of the most famous in Scotland. Mr Donald Stewart was the father of the late Mr John Stewart of Ensay, and through that distinguished breeder, in the later years of the century, the cattle became even better known at the Highland Society and other shows, Mr Stewart being almost invincible, especially with bulls.

On the mainland, the Duke of Sutherland in the extreme north, the Earl of Seafield in the county of Moray, the brothers Stewart of Auch, Cashlie and Chesthill in Argyll and Perth, and the Marquis of Breadalbane likewise in the latter county, also rendered great service to the breed. Indeed, the Taymouth sale of the Marquis of Breadalbane is one of the landmarks in Highland cattle history. It was held in 1863 and excited extraordinary interest. One of the bulls sold—viz., "Donull Ruadh," a two-year-old—made £136. Cows sold up to £57; three-year-old heifers to £125; two-year-old heifers to £71; yearling heifers to £46; and three- and four-year-old bullocks to £43. These, of course, were remarkable prices for the time, and they held the record for Highland cattle up to the dispersion of the Earl of Southesk's Kinnaird fold in 1905, when 78 head of breeding animals made the splendid average (for Highland cattle) of £48, 12s.

Several of the finest of the Taymouth cattle of 1863 were bought by the Duke of Atholl, and they became the founders of the famous Atholl fold, which has produced so many noted animals in late years. Other breeders, in addition to the Duke of Atholl and the Earl of Southesk, who have rendered special service to the Highland cattle cause in recent years, have been the late Mr Smith of Ardtornish; the late Lord Malcolm of Poltalloch; Sir Wm. Ogilvy Dalgleish, Bart.; Mr Turner of Kilchamaig; the Countess Dowager of Seafield; and the brothers, Mr Duncan M'Diarmid, Camusericht, and Mr Robert M'Diarmid, Castles, Loch Awe.

[1] *Herds of Highland cattle are spoken and written of as "folds," the word "fold" being a legacy from the far bygone days of cattle-lifting, when, for protection, cattle had to be folded at night.*

Size and Early Maturity.

A much debated question of late years has been whether Highland cattle have been kept up to the size that they used to display in the old days of the Taymouth fold. A good many people hold that they have not, although it would not be difficult to show that they have been improved in other respects, notably in the quality of their hair and in their ability to fatten quickly. In the olden days steers were not considered ripe until they had reached four or five years old. Now three years old is the most common age at which to fatten them off, while many are made fit for the butcher at two and a half years old.

The cattle have also been greatly improved in their flesh-carrying capacity. At Smithfield Show in 1907 the younger steers averaged 12 cwt. 62 lb. live-weight at practically thirty-two months old, while the older steers averaged 16 cwt. 20 lb. at forty-four months old, individual specimens of course scaling considerably more. These are weights that could never have been attained at the age in the olden days. All the same, it has been becoming increasingly difficult of late years for the Highlander to hold his own, in face of the difficulty of paying rent, and the advance of the more quickly maturing breeds into various of the straths and glens once occupied almost exclusively by Highland cattle.

For Crossing Purposes.—Cattle of the Highland breed are well adapted for crossing with other races. They in particular produce excellent results when crossed with Shorthorns. The most general practice is to mate the Shorthorn male with the Highland female. The resulting crosses are usually animals of handsome proportions and excellent beef-producers.

Temper of Cattle.—Notwithstanding the rather ferocious-like appearance which Highland cattle sometimes present, they are not naturally vicious or evil-disposed. Indeed, the majority of Highland bulls are as easily managed as the bulls of any other breed. A Highland cow will certainly defend her young with vigour, but left to herself she is usually much more docile than her appearance would warrant. The general good character of Highland cattle in this respect is believed to be due to the weeding out of ill-tempered animals, which had of necessity to be done in the old days when there were few marches and fewer fences, and when it was dangerous to the owner's pocket, if not to his person, to have a doubtful animal roaming about. When high-strung cows or bulls are met with they should not be bred from, the former being very apt to become troublesome at calving-times. For the same reason it is always well to know that the bull in use is of as placid and evenly-tempered a disposition as possible.

Herd-Book Society.

A Herd-Book Society in connection with the breed has been in existence since 1884. The Society has been very successful, and has published some fourteen volumes of the *Highland Herd-Book*, the last one bringing the pedigrees of bulls up to 2217, and of females up to 7142. In addition to keeping the pedigrees of the animals the Society holds a sale of pedigree animals twice a-year at Oban—that for bulls taking place towards the end of February, and for cows and heifers in October.

The Breed Abroad.—In recent years Highland cattle have been exported to both North and South America, as well as to New Zealand and one or two other countries. But so far the outside demand has not been so great as the decided merit and adaptability of the cattle for special situations would have led one to expect.

MANAGEMENT OF THE BREED.

The management of the Highlander is simplicity itself compared with what it is in the case of some other breeds of cattle. Even on the mainland many Highland cattle go out practically all the year round, having only a shed or suchlike protection in winter. On the islands it is not even customary, unless in the case of specially valuable animals, to take in cows at calving-time. This is done, as a rule, on the mainland, and the custom is quite a good one, for in addition to the saving of casualties at this important period, the housing of cows at calving-time enables both cows and calves to be handled more or less. Calves

treated in this way are not so apt to become wild or untractable as those born and reared wholly in the open.

As to feeding in winter, a few turnips and a little straw or hay are about the most that the average stock requires. Even in the case of housed cattle this is usually found sufficient, although a little cake or corn can, as a rule, be fed with profit where it is desired to bring the animals specially well forward for spring.

Newly weaned calves must be kept on good fresh pastures so as not to let them lose their first flesh.

It is a good plan to hand-strip the cows after the calves are taken from them. Many breeders do this regularly, and believe that cows so treated do better in the following year. Although exceptional Highland cows will rear two calves at a time, the general plan is to have only one calf suckling a cow. Considering the rough pasture on which many of them exist, they pay their way well enough when they rear one calf per season and do it well.

Young stock, after the weaning stage has been got over, usually give little or no trouble, and with a little hay or straw and a few turnips on the pasture in winter will make a wonderful existence.

It is, however, a mistake to suppose that Highland cattle will exist on next to nothing. They will certainly live on poor fare compared with most other breeds, but starvation can only have one result.

In most regular folds the surplus young stock are sold in lots at the Oban, Inverness, Stirling, Perth, or other markets in the back end, usually October. In 1908, at Oban, three-year-old bullocks were making up to £17, 10s. per head, two-year-old bullocks to £14, 15s., and stirks to £12, one specially fine lot selling at £15, 10s. per head.

The Atholl Fold.

The following notes, kindly supplied, in regard to management in the Atholl fold, will be of interest:—

The fold of Highland cattle kept by the Duke of Atholl at Blair Castle is limited in number. The cows, of which there are not at any time more than fifteen, begin calving about 1st January. The calf is left with the cow for about twenty-four hours, when it is placed in a loose-box at the end of the byre, and thereafter let with the cow only twice daily—morning and evening. As soon as the calf is able to eat it gets turnips and meadow-hay.

The cows are all kept in their natural condition, and are not taken to shelter until within about three weeks of calving, unless during severe storms, when they get oat-straw. They get nothing but what they are able to gather when on rough pasture.

The erection they are housed in when near calving is in the form of loose-boxes with outside pens or runs. The loose-boxes are each 10 by 8 feet, and the outside runs 25 by 8 feet. There they are fed twice daily on turnips and meadow-hay, with a plentiful supply of water.

In spring, when turned out on low-lying pasture the cows and calves get together, and there they are allowed to remain until the hill-pasture, which is a month later, is able to support them. They are sent to the hill (part of the Atholl Forest) about 1st June, depending upon the season, and are left there until the middle of October, when the calves are weaned.

Heifers drop their first calf at four years old. The young stock are never housed. They are fed once a-day on meadow-hay and turnips, getting the hay in haiks in an open shed or shelter, the turnips spread on the pasture. In winter the newly-weaned calves are kept by themselves, and the two- and three-year-olds in other enclosures, getting the same feeding as the younger animals.

All the spare stock are sold in autumn.

Castle-Grant Fold.

Owing to the very severe winters in Strathspey the cattle in the fold kept by the Dowager Countess of Seafield at Castle-Grant, Grantown-on-Spey, are housed from the last week of November till the first week of April. The cows are tied two in a stall and do not get out during the day. The young cattle are all out together every day from daylight till dark, and are housed at night in loose-folds according to age and size. All are fed on turnips and oat-straw only, the cows getting one feed per day of bruised oats from the time of calving

till they go out in April. When they go out they get turnips and ensilage till they have grass, which usually keeps them by the second or third week of May. Summer feeding consists of permanent grass, at 750 feet above sea-level.

The bull runs with the cows and heifers at 1st of April when they go out. Heifers are served at three years old. The feed of bruised oats has been found to bring the cows earlier to the bull, as they are in better heart when put out. The early calves are suckled till the end of August; the late ones, a month or two longer.

The bull-calves when taken from the dams are housed in separate boxes with open pens in front, and they get a run to grass (separately) for several hours every day till sold.

For the summer shows only the cow or cows to be exhibited get cake. The heifers get nothing but the grass. For the fat shows the steers are housed all the winter and summer previous to the show, and are sold rising three years old. A heifer or two, usually the worst of the age (three years old), are kept from the bull and fed also.

The home farm at Castle-Grant is worked as an ordinary arable farm, the housing of all cattle for four months and the feeding of steers and heifers providing a large supply of manure. Sheep are grazed and fed on the rotation pasture, and the cattle grazed on the permanent pasture.

Plate 40 represents a handsome Highland bull, and Plate 41 an equally typical cow of the breed.

WELSH BLACK CATTLE.

Welsh Black cattle as they exist to-day have perhaps departed as little from the original type as any of our British breeds. During the early part of last century there were several distinct varieties, all of which appear to have had a common origin. Most of these have now practically disappeared, having been replaced by other breeds from across the English border. For example, the old Glamorgan breed, which was at one time much esteemed both for the production of beef and milk, is now almost extinct, and the White Pembrokes exist in such small numbers as to be negligible.

Historical.

Of these old varieties the Castle Martins, or Pembrokes, and the Anglesey breed are the only ones which remain. For the last century or more these have been described by all writers as similar in character, and there can be no doubt that they, at any rate, sprung from the same stock. Such differences as do exist, or have existed, are mainly due to environment, and are not greater than are to be found in Shorthorns bred and reared under varying conditions.

In describing the Castle Martins Youatt said: "Great Britain does not afford a more useful animal. . . . They combine to a considerable degree, and as far perhaps as they can be combined, the two opposite qualities of being very fair milkers with a propensity to fatten. The meat is generally beautifully marbled. It is equal to that of the Scotch cattle, and some epicures prefer it. They thrive in every situation. They will live where others starve, and they will rapidly outstrip most others when they have plenty of good pasture. . . . Great numbers of them are brought to the London market. They stand their journey well and find a ready sale, for they rarely disappoint the butcher, but, on the contrary, prove better than appearance and touch indicate." Further, Youatt said that Castle Martin cattle were essentially the same as those of North Wales, but finer in the neck, head, and breast than the Anglesey beasts.

For a good many years the North and South Wales breeders had each their own herd-books, but in 1904 the two Societies amalgamated, so that now the Welsh Black Cattle Society represents the interests of all breeders of Welsh cattle.

Characteristics.

In appearance Welsh have a greater resemblance to the Sussex than to any of the other English breeds of cattle. The only recognised colour is black, but a little white on the udder or scrotum is not objected to. The horns, which are of a creamy colour with dark tips, are long, and are bent slightly forward in the males, in the females they usually incline forward and upward. There are frequent complaints that the high-pitched horn, so characteristic of the breed, is giving place to a shorter horn, which in many cases would seem to indicate doubtful parentage. As a rule, the cattle are short in the leg, with long bodies, are occasionally inclined to be rough on the shoulders, and are not always straight in the top line. They are deep in the ribs, which are better sprung than formerly. They are not so wide across the hips as the Shorthorn, and are more rounded in the hind quarters. The skin should be of moderate thickness, as experience has shown that animals with thin skins are not hardy enough to withstand the varying conditions of climate which are experienced in many parts of Wales. In the best Welsh herds most of the cattle have lost the high-set tails which were universal a generation ago. They are also stronger at the heart girth, and, generally speaking, are more regular in outline than prior to about 1880.

Hardiness.—One of the main characteristics of the breed is its hardiness. In this respect they are equal to the Highland (Scotch). They will live under conditions in which most of our breeds could not exist. In the lowland districts many cattle are wintered out and receive no food except the grass they pull, unless the ground be covered with snow, when they usually get a little hay. In the mountain districts the shelter provided is not usually of the best, and as the stock of hay, which is always poor in quality, is limited, it is only given to the cattle when the weather is very severe. The hardy character of the breed has always been recognised by the large graziers in the Midland counties of England, who buy the best of the store cattle, which, though forward in condition, will live out even in March and continue to improve.

Rate of Maturity and Weights.—Welsh cattle have been subjected to criticism on the ground that they are slow feeders. This is certainly true of some of the cattle which have been reared so hard as to become stunted in their growth, but that it is true of Welsh cattle as a whole there is no evidence to show. The contrary, indeed, can easily be proved. *The Live Stock Journal* publishes annually particulars of a large number of the cattle exhibited at the Smithfield Show and afterwards slaughtered. The following figures for the years 1900 to 1905 relating to cattle under two years old, indicate the position which Welsh occupy with regard to other breeds :—

Breed.	No. of Entries.	Average age (days).	Average daily gain (lb.)
Aberdeen-Angus	37	678	2.12
Devon	33	679	1.81
Galloway	25	663	1.65
Hereford	30	672	2.14
Red Poll	20	644	1.87
Shorthorn	33	677	2.17
Welsh	36	705	2.08

From these figures it would appear that Welsh cattle are little, if at all, behind the Aberdeen-Angus, Hereford, and Shorthorn, when considered from the standpoint of early maturity.

Grazing Properties.—The figures quoted above refer solely to stall-fed animals, but it is as grazing stock that the Welsh show to greatest advantage. They are for the most part in the hands of small farmers, who have, unfortunately, in order to secure a little more money, been induced to sell to English graziers many of their best animals, with the result that many inferior animals have been kept at home for breeding.

Quality of Beef.—As producers of beef of high quality the Welsh occupy a position very near to that of the Aberdeen-Angus. They furnish beef in which the fat and lean are well mixed, and which generally is of that marbled character so much sought after by those who can afford to pay the best prices. The carcase competitions at the Smithfield Show provide a remarkable testimonial to its quality. During the five years 1901 to 1906 Welsh Black cattle won in

these classes, in addition to minor prizes, 6 first prizes and 1 Championship prize. They are looked upon by Scottish breeders, who have always been successful exhibitors in these classes, as their greatest rivals. As they also yield a high proportion of carcase to live-weight, they are always regarded with favour by butchers. This is nowhere more evident than at the Smithfield Show, where all the Welsh cattle are invariably sold on the first day of the show.

Milking Properties. — Although chiefly known outside Wales as beef-producers, Welsh cattle are able to hold their own as dairy stock. It is open to question if the returns in the form of dairy produce obtained from Welsh cows by the small holders of Wales are excelled in any part of Great Britain. Dairy records are almost unknown in the country, and the only figures at hand relate to the Madryn herd of 30 cows, the property of the University College of North Wales, which are not above the average as dairy cattle. In this herd the milk and butter sold from each cow have, during the five years 1903-8, produced on the average from £17 to £20 per year. In addition to this, all the cows have, with one or two exceptions, reared their own calves.

As may be inferred, the conditions under which the produce is disposed of are not unfavourable, but any advantage in this respect is possibly more than outweighed by the fact that many of the cows are essentially beef-producers and do not give much milk. While it cannot perhaps be said that, taken all round, Welsh are equal to Shorthorns as dairy cattle, it is no doubt true that on many Welsh farms the milk yield from the dairy cows averages from 500 to 600 gallons a-year.

On stock-raising farms two, and frequently three, calves are reared for every cow kept. The returns of the Board of Agriculture show that in no part of the country are there more cattle on a similar area than in the county of Anglesey, where from forty to fifty young cattle may often be found on the farm on which they have been reared, and where not more than six or seven cows are kept.

Need for Pioneer Improvers.

It is evident from what has been said that Welsh cattle appear to have retained the characteristics for which they have long been famous. No less an authority than Bakewell thought that, next to the breed with which he commenced his operations, the Welsh approached his ideal more nearly than any other. It is perhaps surprising that a breed which occupied such a prominent position in Bakewell's time should have made so little progress. It must be remembered, however, that they have known no improvers in the ordinary sense of the term, and would have been unable to hold their ground but for the good qualities which are inherent in the breed. A more active policy must be pursued if the breed is to keep its place in the front rank, not to speak of extending its boundaries both at home and abroad.

Where Improvement is Required.

In these days no breed can hope for wide popularity if it is lacking in symmetry, and in this respect, says Professor Winter, Welsh cattle are apt to be wanting. They are also frequently rough in the shoulders and flat on the ribs, while in many of them there is more than a tendency to bareness on the rumps.

If Welsh breeders can improve their cattle in these particulars without materially changing the character of the breed, they will accomplish work which cannot fail to be of service to the country, and which, at the same time, is certain to bring profit to themselves. They must see to it, however, that the breed maintains its hardy character, and continues to produce beef of the quality which is now so much prized. Further, it is absolutely essential in the districts in which Black cattle are found that the cows should be at least fair milkers.

More Enterprise Required.—It is feared that these improvements will take long to accomplish unless more enterprise is shown. In purchasing bulls farmers must set up a high standard, and make up their minds that they will not be satisfied with anything which falls short of it. It may be urged that a small farmer cannot afford to pay much for a bull to serve half a dozen cows.

This must be admitted, but where a number of farmers join together the difficulty disappears.

There are many circumstances which seem to indicate that there is a great future in store for Welsh cattle, and that those who register their cattle in the volumes of the Welsh Black Cattle Society and continue to breed on systematic lines will have no cause to regret their action.

Risk in Introducing Out-crosses.—It has been urged that, in order to secure well-sprung ribs and highly developed hind quarters, resort should be had to a Galloway or even a Highland cross. Such a course is open to the gravest objections, and there is reason to expect that its adoption would be more likely to produce deterioration than improvement. The crosses suggested would most probably produce good animals in the first generation, but there would be a great likelihood that for many years afterwards the country would be flooded with mongrels. There are no worse cattle in the whole of Wales than in the regions which lie between the Welsh Black cattle areas and the districts which are monopolised by the English breeds. These cattle are the results of indiscriminate crossing and changing over a long series of years.

Selection Preferable to Crossing.—A good breed is never formed by casual crossing, but by long perseverance in breeding from similar animals until a uniform class of characters is acquired and rendered permanent. For this reason it is generally better to adopt a good breed already formed than to attempt to produce a new one by a mixture of the blood of dissimilar animals. We are confident that by careful selection and the exercise of good judgment the defects which now exist in Welsh cattle can be bred out. The late Mr William Housman, in his report on cattle exhibited at the Royal Show, Windsor, said: "Welsh cattle have unquestionably vast capabilities of both milk and beef production, and their rude health is an important recommendation. Where hardy, active cattle are required—cattle which can live roughly, yet answer to keep and care, grow beef of the first quality and, under favouring conditions, great in quantity—the Welsh breed should claim a trial, and they would doubtless prove ready to adapt themselves to districts and countries to which hitherto they have been strangers."

A High Standard to be Aimed at.—In order to realise these vast capabilities breeders of Welsh stock must take a wider view of the situation than they have done in the past, and be satisfied with nothing but the best for breeding purposes. At the present time nearly all the bull-calves in many of the leading herds in Wales are steered, as breeders find that good young steers are worth as much money as, and can be reared at much less cost than, young bulls. There can be little doubt, however, that as the demand for good stock increases the breeders of pedigree cattle will be prepared to meet it by supplying in increasing numbers such animals as may be required.

MANAGEMENT OF WELSH CATTLE.

In a country in which the climatic conditions are so varied the systems of management must necessarily differ widely. The following particulars relating to the herd of the University College of North Wales indicate broadly the methods pursued in the management of most of the herds on the best lowland farms. The College herd in point of numbers is one of the largest in the principality. It is kept at the College farm, Madryn, near Bangor, and consists of about thirty cows and their offspring.

Calf-rearing.—All the calves are reared; a few of the males are kept for bulls, but the majority are castrated. Those that are intended for show purposes suckle their dams, the rest are fed on new milk for about three weeks, after which separated milk and boiled linseed are gradually substituted, until at five or six weeks old the new milk has been entirely replaced. All calves, except those on their dams, are fed from the bucket until they are at least four months old. The feed usually consists of separated milk and boiled linseed; but oatmeal and, to a certain extent, wheat-flour are also used.

As soon as the calves will eat they are given small quantities of crushed oats

and linseed-cake, with a little sweet hay, and during the autumn and winter a few sliced swedes. The quantities of these are gradually increased, so that by the time the calf is six months old it is receiving from a pound to a pound and a half of concentrated food per day. All calves six months old or over are turned out to grass about the middle of May. The concentrated food is continued for a time, but if grass is plentiful no concentrated food is given after the first fortnight. Shelters from the heat are always provided where possible.

About the middle of August the calves are brought in in the evenings, but continue to run out during the day until the end of October, and often throughout the winter when the weather is favourable. From October onward they are given hay and a small quantity of crushed oats and linseed-cake, and as soon as the grass begins to fail, pulped roots and chaffed hay and straw in addition, the quantities of prepared foods being gradually increased as the winter advances.

Young Stock.—During their second summer the young stock get nothing except what they pull from the pastures. If the weather is favourable and there is plenty of grass, they are kept out until December, when they are brought in at nights and given a feed of pulped roots and chaffed hay and straw night and morning, with long straw in their racks.

Fattening Stock.—The bullocks are fed off for the butcher at from two to two and a half years old.

Breeding Stock.—Heifers are put to the bull so as to calve at from two and a half to three years old.

The cows run out all the year round, but are housed at nights from November to April. During the winter they receive a moderate supply of roots and long hay. Those in milk get, on the average, about 4 lb. of concentrated food (the bulk of which is cotton-cake) daily throughout the year. Some of the milk is sold, and the rest is made into butter.

A portrait of a Welsh cow is given in Plate 43.

KERRY AND DEXTER CATTLE.

Of the different native varieties of cattle that have from time to time been reared in Ireland, the Kerry and its subvariety the Dexter-Kerry alone remain. The Kerry and the Dexter-Kerry are now, by most people, looked upon as practically separate breeds; but there are those who still think it more accurate and preferable to regard the Dexter as a sub-variety of the Kerry. Both varieties have earned good names for themselves in England as well as in their native country.

Origin of the Kerry.

It is generally acknowledged that nowhere in the British Isles is there a purer representation of the smaller varieties of the aboriginal cattle of Northern Europe than is provided in the Kerry cattle of Ireland. They are the smallest of the many varieties of British cattle, and none possess more distinctive features or more certain marks of purity of descent. Their individuality is indeed very striking, and although small in size and slow in maturing, they are most useful cattle in their own proper sphere.

Headquarters.—The breed has its headquarters in the bleak steep hills of county Kerry, where it has had to subsist upon scanty fare, exposed to wind and rain, with little artificial shelter or attention of any kind. This untoward treatment has of course told its inevitable tale. It has cramped the stature of the cattle, and made them slow in maturing; but it has also endowed them with a sound constitution and exceptional hardiness, as well as the rare and useful faculty of existing and feeling happy on small fare.

Kerries as Emigrants.—Proverbially, Irishmen make the best of emigrants. A similar property can be claimed for the Irish national breed of cattle; for the

little Kerry "adapts itself readily and agreeably to change of scene, and seems as much at ease in the wooded parks of England as on the rocky heights of its Irish home." As already indicated, Kerry cattle have been largely introduced into England, where they are found specially useful on poor land and in small family dairies.

The Typical Kerry.

In outward form Kerry cattle are somewhat similar to the cattle of Brittany, fully as high, but rather more slender and deer-like. The Kerry is active and graceful, long and light in the limb, head small and fine, throat and neck slight and clean, eyes prominent and keen, horns turned upwards, and white with black tip; shoulders thin and sloping, and sharp on the top; chest fairly wide, back straight but rather narrow; ribs fairly well sprung, barrel not deep, hooks wide, quarters long but often uneven; tail-head sometimes rather high, tail slight and long, thighs thin; udder large in size and well shaped, being full behind and carried well forward; milk-veins full and well defined, skin moderately thick and mellow, colour usually black, but some have white spots underneath, and now and again a red Kerry is seen.

The bull is thick, straight, fine in the skin, with good masculine head and neck. Many of the animals have curiously "cocked" horns, first projecting forwards and then taking a peculiar turn backwards—caused, says an Irish wag, by the strong winds the cattle have to face in mounting the Kerry hills!

Origin of the Dexter.

The origin of the Dexter variety, so distinct from the typical Kerry, is enveloped in uncertainty. There is general agreement in regarding the Kerry breed as the main parental stem. As to the development of the sub-variety different theories are put forward. One theory is that the variety was established by the interbreeding of carefully selected Kerries of a low-set thick type, without the aid of any extraneous blood. A more general belief is that the Dexter sort was originated by mating thick, short-legged Kerry cows with bulls of a similar type belonging to another breed, most probably the Devon.

This latter is the view put forward by Professor James Wilson in an exhaustive paper on the subject submitted to the Royal Dublin Society in November 1908.[1] There are authentic records of the introduction of Devon cattle into the south of Ireland early in the nineteenth century, and, on the whole, Professor Wilson seems to be well justified in stating that the probability "that Dexter cattle are descended from black Kerries and red cattle of Devon type is very high." He adds: "If further proof were wanted, it can be found by setting a red Dexter cow side by side with a red Devon. The only difference between them is that the Devon cow is now slightly larger—a matter that can be accounted for by the Devon having been much better cared for and increased in size during the last hundred years."

Origin of the name of Dexter.

The origin of the name as well as of the variety itself has long been the subject of speculation. Less or more directly it would seem to be associated with a Mr Dexter who, about the middle of the eighteenth century, went from the south-west of England to act as land agent to Lord Hawarden in Tipperary. Arthur Young in his *Tour in Ireland*, published in 1780, refers to Mr Dexter as a stock breeder, remarking that "there have been many English bulls introduced for improving the cattle of the country at a considerable expense, and great exertions in the breed of sheep: some persons, Mr Dexter chiefly, have brought English rams, which they let out at seventeen guineas a season, and also at 10s. 6d. a ewe, which indicates a spirited attention."

To that Mr Dexter the credit was given by Low of having founded the Dexter variety of cattle.[2] Others, including Professor Wilson, doubt whether Mr Dexter really founded the variety. They believe that the Dexter type was developed in Co. Kerry, not so far from the home of the Kerry breed as Co. Tip-

[1] "The Origin of the Dexter-Kerry Breed of Cattle." Royal Dublin Soc., 1908.

[2] Low's *Domesticated Animals of the British Islands*, 1842.

perary, and they account in another way for the thick, squat Kerries getting to be known as "Dexters." As Arthur Young indicates, Mr Dexter was a distinguished breeder of sheep. Sheep bred by him became known in the south of Ireland as "Dexters"; they were thick and short-legged, and it is said that in course of time the habit grew of applying the term "Dexter" to all animals, and even to men abnormally short in stature and thick in the body.

Type of the Dexter.

The Dexter is an animal of a very different type from its parent the Kerry—much shorter in the leg, thick and plump in the body; indeed, in all respects excepting that of size, an admirable sample of a beef-producing animal. If less elegant and "milky" looking than the typical Kerry, the Dexter is decidedly more symmetrical; and if increased in size, as by selection in breeding and liberal treatment it might soon be, it would be found to be a very profitable class of stock. The Dexter is very hardy and docile, easily fattened, and produces beef of the very choicest quality.

Deformed Dexter Calves.—A tendency in the Dexter variety of cattle to occasionally produce deformed calves has long been a cause of perplexity to breeders. Sometimes the calf is dead born, and in other cases it may be alive but is so misshapen as to be of no value. The occurrenee of this misfortune became more frequent after herd-book registration required the Dexter variety to be bred within itself, no longer permitting the use of Kerry bulls. To thoughtful breeders this tendency in the "Dexter" has been the subject of interesting and earnest study. It is generally looked upon as "proof positive" of the "hybrid" origin of the "Dexter." That the defective strain can and will be bred out is not doubted, but skill and perseverance will be required. In the meantime it is suggested that breeders of Dexters should be permitted to make occasional fresh infusions of Kerry.

Characteristics of Kerries and Dexters.

The general body of farmers in Ireland have never given anything like so much attention as they might, with advantage to themselves bestow upon the breeding and rearing of Kerry and Dexter cattle as pure breeds. The breeds certainly possess characteristics which, with careful cultivation, would earn for them an excellent reputation as rent-paying stock. They are specially adapted for high, cold situations where food is not too plentiful. As dairy cattle they have gained a good name. Indeed it may be doubted whether there is any breed of cattle in this country which will beat the Kerry in the return in milk and butter from a given quantity of food. Youatt gave the Kerry cow a high character, and yet he was well justified in what he said: "Truly the poor man's cow, living everywhere, hardy, yielding for her size abundance of milk of a good quality, and fattening rapidly when required."

Improvement.—Early in the closing quarter of the nineteenth century a number of enterprising breeders, prominent amongst which were the late Mr James Robertson, La Mancha, Malahide, Co. Dublin; Mr Pierce Mahony of Kilmorna; and Mr Richard Barker, St Ann's Hill, Co. Cork, organised efforts for the systematic improvement of Kerry and Dexter cattle, and from these efforts great benefit has been derived. A Herd-Book for Kerries and Dexters was published by the *Irish Farmers' Gazette* in 1887, and it was soon after taken in hand by the Royal Dublin Society, which has done much to improve and popularise the breeds. An *English Kerry and Dexter Herd-Book* was established in 1900 by the English Kerry and Dexter Cattle Society, which was founded in 1892.

Weights and Measurements.—Since the systematic improvement of the breed set in the weights of Kerry cattle have somewhat increased. The following are the live-weights of animals in Mr Mahony's herd at Kilmorna: Bull, 2 years 8 months and 2 weeks old, 8 cwt. 1 qr.; bull, 15 months old, 5 cwt. 2 qrs. 7 lb.; bull, 12 months old, 4 cwt. 1 qr. 15 lb.; bull, 8½ months old, 4 cwt. 2 qrs.; cow, aged 4 years, 6 cwt. 2 qrs. 7 lb.; heifer, 2 years and 2 months old, 6 cwt. 21 lb.; heifer, 14 months old, 4 cwt.

Mr James Robertson's famous prize cow "Rosemary" was one of the most

handsome Dexters ever seen. Her height at the shoulder was only 3 feet 4 inches, and yet behind the shoulders she girthed 5 feet 7 inches, her length from the shoulder-top to the tail-head being 3 feet 9 inches; and what is more remarkable still, her udder when in full milk girthed no less than 34 inches.

Milking Properties.—In regard to milking properties, Kerry cows occupy a high position. They often excel both the Jersey and Guernsey breeds in quantity, and are not far behind either in the quality of their milk. In the milking trials at the London Dairy Show Kerry cows have in different years averaged from about 28 to 40 lb. of milk per day, with percentages of butter fat ranging from about 3.50 to 4.50. Cows of the breed have exceeded 1000 gallons in a year. Dexter cows are only to a slight extent inferior to the Kerry in milking properties. Many Dexter cows give from 25 to 35 lb. of milk per day, and the butter fat usually reaches 3.30 to close on 4 per cent.

Kerries and Dexters as Beef-Producers.—Though more valuable for dairy purposes than for beef-production, Kerry cattle are not deficient in fattening properties. When well treated with food they take on condition speedily, and the quality of the carcase is well spoken of by butchers. But as beef-producers Dexters stand decidedly higher. They not only mature early but they take on a remarkably thick, firm, level cover of meat of the choicest quality, the cut being exceptionally deep on the parts where the most valuable meat is carried. For its size there are few better or handsomer butchers' beasts than a well-finished Dexter bullock.

For Crossing Purposes.—Both Kerries and Dexters are well adapted for crossing with other breeds. For dairy purposes they are often crossed with Channel Island and Ayrshire breeds, and for general purposes with other breeds—Shorthorns in particular. By skilful crossing with the Shorthorn a valuable breed of Dexter-Shorthorns, described in page 135, has been built up at Straffan, Co. Kildare.

Colour.—Black is the predominating colour of both breeds. Kerry bulls should be pure black, but a small amount of white on the organs of generation and a few white hairs in the tail are permissible. Cows and heifers of the Kerry breed should be pure black, but there may be a small extent of white on the udder and in the tail. Dexters, both male and female, may be either black or red with little streaks or patches of white.

MANAGEMENT.

Little need be said here regarding the management of herds of Kerries and Dexters. As a rule, the methods pursued are simple in the extreme. The hardy character of the cattle enables them to live largely in the open air, and they are singularly frugal in their fare. They can subsist on poorer pastures than any other of the pure breeds of this country. On moderate pastures they need little and seldom get any extra food.

When kept in houses, Kerry and Dexter cows are fed similarly to other dairy cattle, but the allowances are smaller than for animals of larger size. The statement is often made, and it is well founded, that no other variety of cattle in this country can be depended on for a better return for a given quantity of food in either milk or beef or both combined than is usually obtained from a good class of Kerries and Dexters. Better testimony than that need not be asked on behalf of any race of stock.

A portrait of a characteristic Kerry cow is given in Plate 46; an equally typical Dexter cow is represented in Plate 47.

JERSEY CATTLE.

Jersey cattle, which are the most numerous of the Channel Island breeds, have long been recognised for their beauty of form and excellent dairy qualities, especially in the economic production of butter.

Origin.—The origin of Jersey cattle is somewhat obscure, but some writers are inclined to think the breed analogous to the small cattle which abound in Brittany and Normandy. In vol. i. of the *English Jersey Herd-Book*, the late Mr John Thornton directed attention to this view.

As far back as 1763 measures were taken on the Island to keep the breed pure, an Act being then passed by the States of Jersey prohibiting the importation of cattle from France.

Introduction to England.—At what period Channel Island cattle were introduced into England it is hard to say, but at the close of the eighteenth century they were shipped in small numbers to this country. In 1794, in *A General View of the County of Kent*, by John Boys, farmer, of Betteshanger, a description is given of an experimental test between a "home-bred cow," probably a Suffolk, and a small "Alderney" (as Channel Island cattle were then generally termed), in which the Alderney cow produced twice the quantity of butter per gallon of milk yielded.

The year 1811, however, marks the opening of the English trade. In that year Mr Michael Fowler visited Jersey and commenced exporting. His practice was to take the animals to the various fairs in England for the purpose of sale, and in that way he was greatly the means of popularising the breed.

Improvement of the Breed.—The original type of Jersey was not all that could be desired in point of beauty, but by dint of careful breeding and management the animals at the present day have been brought to a high standard of perfection both in their form and produce. The late Colonel Le Couteur did much for the breed on the Island, and was followed by Colonel Le Cornu. In 1834 the Island Society published detailed scales of points for judging bulls and cows; in 1852 farmers' clubs were started in Jersey, and in 1871 separate classes were established for Jersey cattle at the show of the Royal Agricultural Society of England at Wolverhampton.

Characteristics.

Jersey cattle are the smallest in size of the Channel Island varieties. They are mostly fawn or greyish fawn in colour, a few having patches of white, the majority being whole-coloured—that is, without any white on them.

The males are generally of a darker hue, and in both sexes extreme dark colours are occasionally found, a few being nearly black. They are generally described, for registration in this country, as whole- or broken-coloured, the former being more sought after for exhibition purposes.

Their attractive appearance and gentle character render them an ornament for the park, and their abundant and long-sustained supply of rich milk is a valuable asset for the dairy.

Scale of Points.—The scale of points adopted by the Royal Jersey Agricultural Society is as follows:—

Cows.

	Points.
1. Head fine, face dished, cheek fine, throat clean	4
2. Nostrils high and open, muzzle encircled by a light colour	2
3. Horns small and incurving, eye full and placid	2
4. Neck straight, thin and long, and lightly placed on shoulders	5
5. Lung capacity as indicated by width and depth through body immediately behind the shoulders	3
6. Barrel deep, broad and long, denoting large capacity; ribs rounding in shape	10
7. Back straight from withers to setting of tail; croup and setting on not coarse	6
8. Withers fine and not coarse at point of shoulders	4
9. Hips wide apart, rather prominent and fine in the bone	2

10. Hind legs squarely placed when viewed from behind and not to cross or sweep in walking	2
11. Tail thin, reaching the hocks, good switch	2
12. Udder large, not fleshy, and well balanced	10
13. Fore udder full and running well forward	10
14. Rear udder well up, protruding behind and not rounding abruptly at the top	8
15. Teats of good uniform length and size, wide apart and squarely placed	7
16. Milk veins large and prominent	3
17. Richness as indicated by a yellow colour on horns, escutcheon and inside of ears	3
18. Skin thin, loose and mellow	4
19. Growth	3
20. General appearance: denoting a high-class and economical dairy cow	10
Perfection	100

Bulls.

	Points.
1. Head broad, fine; horns small and incurving; eye full and lively	5
2. Muzzle broad, encircled by a light colour; nostrils high and open; cheek small	5
3. Neck arched, powerful and clean at the throat	7
4. Withers fine; shoulders flat and sloping	5
5. Lung capacity as indicated by depth and breadth immediately behind the shoulders	8
6. Barrel deep, broad and long, denoting large capacity; ribs rounding in shape	12
7. Back straight from withers to setting of tail; croup and setting on not coarse	10
8. Hips wide apart, rather prominent and fine in the bone	5
9. Loins broad and strong	5
10. Legs rather short, fine in the bone, squarely placed and not to cross or sweep in walking	5
11. Rudimentary teats squarely placed and wide apart	5
12. Tail thin, reaching the hocks, with good switch	2
13. Well grown according to age	3
14. Hide thin, loose and mellow	5
15. Showing a yellow colour on skin and horns	3
16. General appearance: denoting a high-class male animal, typical, and of a class suitable for reproduction	15
Perfection	100

Weight. — The average weight of Jerseys is well under 900 lb. At the English Jersey Cattle Society's Show at Kempton Park in 1890, the only exhibition solely for Jersey cattle ever held in England, all the animals were weighed. Twenty-four English-bred animals 5 years 8 months old weighed on an average 826 lb. live-weight, while thirty Island-bred, each 5 years 4 months, averaged 735 lb. live-weight. These figures show that the Island-bred animals are about one-ninth less in weight than those bred in England.

English Improvers.

The efforts of Colonel Le Couteur and Colonel Le Cornu on the Island to improve the condition and milking qualities of the breed were seconded in this country by several breeders. Mr Philip Dauncey founded his celebrated herd at Horwood, Winslow, Buckinghamshire, about 1825. The herd usually numbered about fifty cows, and 14 lb. of butter weekly were often obtained from one cow; in June 1867 the fifty cows gave an average of over 10½ lb. of butter in one week. Mr W. G. Duncan of Bradwell, whose herd was started in 1849, and Lord Chesham, who began his at Latimer, Chesham, in 1850; Mr Palmer of Stewkley, Buckinghamshire; Mr Edward Marjoribanks, Watford; Mr Selby Lowndes; and Sir Walter Gilbey, Bart., were among the earliest English breeders; also Lord Braybrooke at Audley End, and Mr Archer Houblon at Great Hallingbury, Essex.

English Jersey Cattle Society.

At Mr George Simpson's sale in 1878, at Wray Park, Reigate, a Committee was formed to establish a Herd-Book for Jerseys in England. The late Mr John Thornton was appointed Honorary Secretary, and the first volume of the *English Herd-Book* was issued in 1880, an exhaustive history of the breed being published in that volume. From that date a steady improvement proceeded in England.

In vol. xix. of the *English Jersey Herd-Book*, published in 1908, there are 346 entries of bulls, and 1252 entries of females.

Milk and Butter Tests.—Milk and

butter records were kept by some of the leading herds and printed in the Herd-Books and Supplements. In 1886 the late Mr John Frederick Hall, then living at Erleigh Court, Reading, suggested that public butter tests should be carried out under the auspices of the Society at the various agricultural shows, and he conducted the first one personally at the London Dairy Show in that year. From that time till 1908 no fewer than 2476 Jersey cows were tested at the leading agricultural shows, and the results give an average of 1 lb. 10½ oz. of butter from 31 lb. 13 oz. of milk 112 days after calving, —a record that reflects the highest credit on the breed.

These tests have had great influence on the improvement of the dairy qualities of Jersey cattle.

Records of Dr Herbert Watney's herd at Pangbourne, Reading, one of the most successful in these competitions, have been published in the Herd-Books since 1899. The average weight of butter per head in 1898 was 373 lb., whereas in 1907 it was 404 lb.

Accurate accounts of milk yields have also been kept of Lord Rothschild's herd at Tring Park, Herts. In 1907, eighteen cows that had been in the herd during the whole year averaged 7455 lb. of milk.

Merits of Jersey Cows.—Mr Ernest Mathews, in a paper on "The Jersey Cow," read before the British Dairy Farmers' Association, in Jersey, 1905, stated: "A Jersey cow will give as good a return to her owner, where milk is sold, as the larger breeds of English cattle, since her live-weight, which has something to do with the quantity of food she consumes, is considerably less than theirs, her period of lactation is much more prolonged, while the quality of her milk is so much richer that not only a higher price can be obtained for it, but there need never be any fear of legal proceedings on the ground that 3 per cent of fat and 8.5 per cent of solids other than fat are not present in the milk."

The Jersey cow is to be found in all parts of the world—large numbers being exported annually to Denmark and the United States.

MANAGEMENT OF JERSEY CATTLE.

The feeding and management of Jerseys vary somewhat according to the constitution of the animals and the locality in which they are situated. "The majority of English breeders regard home-bred Jerseys as stronger in constitution than those bred on the Island, while the minority consider that Island-bred cattle if taken care of the first two winters eventually become as hardy and profitable as the English-bred animal."[1]

With regard to bulls, breeders agree that they should have had good dairy ancestors for two or three generations, and that individual appearance should be closely studied.

In the Island of Jersey a masculine-looking bull is preferred, but in England by some breeders a bull of feminine appearance is selected.

It is the general practice to turn the cows out during the day excepting in very inclement weather.

A breeder in Hertfordshire writes: "If a herd of Jerseys is to be kept solely for dairy purposes, regardless of showing and appearance, I should turn the cows out during the day from about the middle of May if the weather is suitable—as the nights get warm."[2] A breeder in Kent "turns out all the animals daily, and considers it a matter of great importance if you desire a healthy herd."

A shed should always be provided where the animals can take shelter in wet or stormy weather, — the object being to keep the animals in a healthy comfortable state.

In the feeding of Jerseys the peculiarities of the animal have to be considered. In order to keep up her flow of milk the cow should receive just as much food as she can properly digest, care being taken to avoid a diet too rich in albuminoids. The best and most natural food is the early grass in the spring of the year, which generally lasts till June, when lucerne, rye, trifolium, sainfoin, and other rotation crops can be ready. The flow of milk can be maintained by such

[1] *Jersey Cattle: Their Feeding and Management.* Published for the English Jersey Cattle Society by Vinton & Co., London.

[2] *Jersey Cattle: Their Feeding and Management.*

feeding until later in the year. When this food becomes coarse, roots may be substituted.

For milk-production cabbages, carrots, swedes, mangels, grains, both wet and dried, crushed oats, bran, cotton- and linseed-cake are recommended. For butter-production swedes and turnips are to be avoided, and carrots, parsnips, cabbage, and kohl-rabi are recommended.

Example Rations. — The following four examples of feeding rations are given in the English Jersey Cattle Society's Handbook on the Feeding and Management of Jersey Cattle:—

Example I.	Lb. per day.
Carrots	12
Chaff, oat-straw	5
Chaff, good hay	5
Decorticated cotton-cake	2
Crushed oats	2
Coarse wheat-bran	2
Hay, good	7

Example II.	
Drumhead cabbage, inner leaves	12
Chaff, as in Example I.	10
Linseed-cake	2
Crushed oats	2
Bran	2
Good meadow-hay	7

Example III.	
Mangels	14
Chaff, as above	10
Decorticated cotton-cake	3
Maize-meal	3
Hay, good	7

Example IV.	Lb. per day.
Mangels	14
Chaff, as above	10
Decorticated cotton-cake	2
Maize-meal	2
Malt, sprouted	2
Hay, good	7

The number of feeds are naturally fewer when the animals are turned out.

In the Channel Islands it is the custom to tether the cows on the pasture fields, the animals being moved every two hours or so. They are in some cases milked three times daily.

Care of Bulls.—Bulls should be kept in good hard condition; an addition of crushed oats and linseed-cake with the ordinary feed of roots and chaff is good. In summer they should have grass, lucerne, and cabbages, but vetches are not recommended. Generally speaking, the bulls are in service from one to four years old.

Calving.—The cows are usually dried off from four to six weeks before calving. As soon as the calf is born, if left with its mother, it should be rubbed over with a little salt, which induces the cow to lick the calf. The cow should be kept warm and free from draughts, and milked frequently, a little being drawn off at a time.

Heifers, as a rule, produce their first calf when two years old.

A portrait of a beautiful Jersey cow is given in Plate 44.

GUERNSEY CATTLE.

The origin of Guernseys, like that of other Channel Island cattle, is not definitely known, but it may be assumed that they are a branch of the Normandy breed. In his work on Domestic Animals (1845) Professor Low remarks that Guernseys deviate from the ordinary type of Channel Islands cattle, and present a greater affinity to the races of Normandy.

In common with other Channel Islands cattle, which were at one time generally termed "Alderneys," they have long been valued for their dairy qualities. Being of a larger frame than Jerseys, bigger in bone and more prone to fatten, they may be considered more of a dual purpose type. Their flesh makes excellent beef, but being of a high colour like Jerseys, with yellow fat, is not popular with butchers in this country.

Early in the last century it was proposed in Guernsey to allow cattle to be imported from France and other neighbouring countries with the object of reducing the price of butchers' meat and increasing the export trade, but this was negatived by an act of the Royal Court, and all cattle now landed are slaughtered,

the only exception being Guernseys that have been sent to England for exhibition.

In the year 1811 Mr Michael Fowler began importing from the Channel Islands, and from that period a steady trade has increased for Guernseys in England.

Characteristics.

Guernseys generally range from about 900 lb. live-weight to 1200 lb. and upwards. Their colours vary from a bright fawn to a reddish fawn, with more or less white about the body. The head is long and well formed, with well-shaped horns; eyes large and prominent, and general appearance and character docile.

The present scale of points, adopted in October 1905 by the English Guernsey Cattle Society, is as follows:—

Cows.

		Points.
Size, Symmetry, and Constitution, 48.	1. Head fine and long; muzzle expanded, with wide open nostrils; eyes large, with quiet and gentle expression; forehead broad; horns curved, not coarse	5
	2. Long thin neck; clean throat; backbone rising well between shoulder blades; chine fine	5
	3. Back level to setting on of tail; broad and level across loins and hip; rump long; thighs long and thin; tail fine, reaching to hocks; good switch	5
	4. Ribs amply and fully sprung, and wide apart; barrel large and deep, with strong muscular and navel development	15
	5. Hide mellow and flexible to the touch, well and closely covered with fine hair	5
	6. Hair a shade of fawn, with or without white markings; cream-coloured nose	3
	7. Size—Cows four years old and over, about 1000 lb.	10
Indication of Milk yield, 10.	8. Escutcheon wide on thighs, high and broad, with thigh ovals	2
	9. Milk veins prominent, long and tortuous, with large and deep fountains	8
Udder formation, 32.	10. Udder full in front	8
	11. Udder full and well up behind	8
	12. Udder of large size and capacity, elastic, silky, and not fleshy	8
	13. Teats well apart, squarely placed, and of good and even size	8
Indicating Colour of Milk, 10.	14. Skin yellow in ear, on end of tail, at base of horns, on udder teats, and body generally; hoofs amber-coloured	10
	Total	100

Bulls.

		Points.
Size, Symmetry, and Constitution, 65.	1. Head fine and long; muzzle expanded, with wide open nostrils; eyes large, with quiet and gentle expression; forehead broad; horns curved, not coarse	5
	2. Long masculine neck; clean throat; backbone rising well between shoulder blades; chine fine	10
	3. Back level to setting on of tail; broad and level across loins and hip; rump long; thighs long and thin; tail fine, reaching to hocks; good switch	15
	4. Ribs amply and fully sprung, and wide apart; barrel large and deep, with strong muscular and navel development	15
	5. Hide mellow and flexible to the touch, well and closely covered with fine hair	5
	6. Hair a shade of fawn, with or without white markings; cream-coloured nose	3
	7. Size—Bulls four years old or over, about 1500 lb.	12
Appearance and Style, 15.	8. General appearance: vigour, style, alertness, and carriage; hind legs not to cross or sweep in walking	15
Rudimentaries, 10.	9. Rudimentaries squarely and broadly placed in front, and free from scrotum	10
Indicating Colour of Milk in Offspring, 10.	10. Skin yellow in ear, on end of tail, at base of horns, and body generally; hoofs amber-coloured	10
	Total	100

The heifers generally drop their first calf when about two years old, and frequently continue breeding and milking to the age of twelve years and over.

The bulls become very heavy when old, and readily fatten for the butcher.

Milking Properties.

Guernseys are excellent dairy cattle, yielding a large quantity of milk rich in butter-fat. The butter produced is high in colour and excellent in quality. In

vol. iii. of the *Royal Guernsey Society's Herd-Book* an official test, dated May 28, 1885, states that the cow "Vesta 6th" (625), born November 20, 1881, yielded 13 lb. 15¾ oz. of butter in one week.

Since the general inauguration of butter tests in England in 1866 there have been numerous examples of the value of Guernseys for the dairy, and in competition with other breeds in the open butter tests they have obtained many awards. The following records of Guernseys, tested at the London Dairy Show from 1895 to 1907, appeared in the *Journal of the British Dairy Farmers' Association* for 1907:—

Year.	No. tested.	Average days in Milk.	Average Butter yield. lb. oz.	Average Ratio =lb. of Milk per lb. Butter.
1895 to 1900	23	71¾	1 9½	21.86
1901	8	81	1 8¾	21.43
1902	1	17	1 3¾	21.46
1903	5	52	1 1	27.77
1904	3	98¼	1 10	20.65
1905	3	165⅔	1 6¾	19.66
1906	2	138	1 3¼	27.00
1907	2	82	1 12½	18.90

The following are the average results of tests carried out during the five years 1904-8, which have appeared in the *Journal of the Royal Agricultural Society of England*:—

Year.	No. tested.	Average yields. Milk. lb. oz.	Butter. lb. oz.	Average days in Milk.	Ratio.
1904	1	46 4	2 7¾	51	18.61
1905	4	38 5½	1 8¼	55	25.29
1906	2	35 3	1 11¾	41	20.28
1907	4	35 4½	1 9¼	123	22.35
1908	1	35 12	1 12¾	135	19.89

MANAGEMENT OF GUERNSEYS.

The systems of management of Guernseys are necessarily those specially adapted for dairy cattle. Tethering is generally practised on the Island, but not in this country. The cattle are considered fairly hardy after becoming acclimatised. Like other milch breeds, they should not be exposed to inclement weather, although they should have plenty of air and exercise, even in winter, care being taken to provide a shed where they can take shelter when necessary.

From May to about the third week in October they are generally allowed out in the fields night and day if the weather is fine, but it is considered that the flow of milk is retarded by exposure to cold and damp. The comfort of the animals should therefore be assured.

In Alderney, where cows and heifers have been in past years imported from Guernsey, and from whence cows and heifers are now exported to Guernsey, mixing with the breed and being entered in the Herd-Book, the custom is to allow the animals out in all weathers. This, no doubt, tends to harden them, but in the general treatment of milch cows warmth and comfort are essential. The supply of food should be ample and of a kind that promotes good butter-yielding qualities, too sloppy food having a tendency to affect the constitution although increasing the flow of milk. The individual digestive capacities of the animal should be studied.

In spring and summer the early grass, followed by such succulent crops as clover, lucerne, sainfoin, &c. (and maize where it can be grown), form a very good diet.

During autumn and winter, cabbage as well as the root crops—carrots, turnips, mangels, kohl-rabi, and parsnips—may be given, but for butter production turnips are usually avoided.

An old breeder in the south of England considers that "the quantity to be given depends on the cows; a good herdsman finds out far better than following any set rule." He recommends the following daily ration:—

Good meadow-hay chaff, according to what the cow will clear up.
Bran, 1½ lb.
Crushed oats, 3 to 4 lb.
Linseed-cake, 1 lb.

Half the quantity to be given in the morning and half in the evening. For roots he recommends carrots, parsnips, a small allowance of mangels, not more than about a pailful in all.

Guernsey Herd-Book.

The first volume of the English Guernsey Cattle Society's Herd-Book was issued in 1885. The Society has done much to improve the dairy qualities of the breed by giving prizes for

dairy tests at the various shows in this country. In the twenty-fourth volume of its Herd-Book, issued in 1908, there are 99 entries of bulls and 376 entries of females.

Guernseys are frequently exported abroad, especially to the United States of America and the Colonies.

A portrait of a representative Guernsey cow is given in Plate 45.

THE DEXTER-SHORTHORN.

This is a new variety of cattle of quite a distinctive type. About 1880 it was founded by Major Barton of Straffan, Co. Kildare, Ireland, by the mating of a Shorthorn bull with a red-coloured Dexter heifer. It was believed that, by the judicious mating of Shorthorn sires with the female descendants of this cross, a useful class of cattle could be established, and the results attained have even more than fulfilled early expectations, high as these were.

For a period of about thirty-five years the only sires used on the Dexter-Shorthorn females were registered Shorthorn bulls of a thick, compact, well-fleshed, short-legged type, chiefly red in colour. All through that period the male calves were castrated, and no heifers were bred from that showed objectionable colours or did not conform to the desired thick, short-legged, well-fleshed type.

By the end of the thirty-five years, during which Shorthorn sires alone were used—that is, in the closing decade of the nineteenth century — the progeny were eligible for entry in Coates's *Shorthorn Herd-Book*. The object of the owner, however, being to establish a distinctive race of cattle, the use of Shorthorn sires was discontinued, and from that time onwards the new variety of cattle has been bred strictly within itself.

A more complete or harmonious blend than is the Dexter-Shorthorn of the two parent strains could hardly be conceived. How long the blood of the Shorthorn and the blood of the Dexter have been running in separate channels no man can tell. Whether the two races had a common origin in the *Bos longifrons*, or whether the Dexter has come down to us from that species, and the Shorthorn from the more gigantic *Bos urus*, must ever remain a mystery. The fact, however, is well established that the Dexter and the Shorthorn breeds have had a distinctly separate existence for many hundreds of years. That the two breeds should blend well is by no means a far-fetched idea. Many is the time the writer has heard typical modern Dexters described as miniature Shorthorns. A good red Dexter cow seemed to want little but size to enable her to rank as a model Shorthorn.

It was a happy idea which led to the two breeds being blended as they have been at Straffan. By Mr Thomas Milne, manager at Straffan, the new variety has been tended from an early period in its existence with a parental care that is pathetic, and in association with his public-spirited employers he has attained marked success in the building up of what is already entitled to rank as an established race of cattle.

The Dexter-Shorthorns differ from the parent breeds only in that they are larger than the one and smaller than the other, and that in colour the black of the Dexter is never repeated, while the whole white of the Shorthorn rarely shows itself. The pure Dexter cow is, for its size, one of the best milking cows in this country. The cow of the new breed retains that characteristic to the fullest extent, giving usually from 18 to 22 quarts of exceptionally rich milk per day. In the production of high-class beef at an early age, the new breed comes quite up to the highest Shorthorn level in proportion to size. In constitutional stamina the Dexter-Shorthorn is all that could be desired. Outstanding features are the thickness of the body and the shortness of the leg. For the most part the cattle are red or dark roan in colour.

No females of the new breed have been sold, but for bulls there is an active demand. They are specially adapted for mating with cows on small holdings, and have been used with excellent results amongst the native cattle in Shetland. Numerous direct and indirect descendants of the Straffan Dexter-Shorthorns have won prizes in fat stock shows.

At the London Smithfield Show in 1908 the cup for the best animal in the classes for "Small Cross-bred Cattle" was awarded to Sir Walter Gilbey for a Dexter-Shorthorn steer bred at Straffan. At the age of two years and eight months this steer reached a live-weight of 1496 lb., showing a daily gain of 1.53 lb.

Plate 48 represents a group of Dexter-Shorthorn cattle. The following are the ages, weights, and measurements of the three heifers named in that group:—

	Daisy.	Dora.	Tidy Bell 3rd.
Age	5 years.	4 years.	5 years.
Live-weight	10 cwt. 2 qrs.	10 cwt.	10 cwt. 1 qr.
Height	3 ft. 10 in.	3 ft. 11 in.	3 ft. 10 in.
Girth[1]	7 „ 0 „	6 „ 8½ in.	6 „ 8 „
Length[2]	6 „ 3 „	6 „ 6 „	6 „ 2 „
Fore leg[3]	1 „ 6 „	1 „ 10 „	1 „ 10 „
From dewlap to ground	1 „ 1 „	1 „ 3 „	1 „ 4 „

[1] Behind shoulder. [2] From root of horn to square of tail. [3] From arm-pit to ground.

OTHER BREEDS OF CATTLE.

LONG-HORNED CATTLE.

This ancient and characteristic breed of cattle, once numerous and widespread in England, has become reduced to very narrow limits and to quite a few herds. It was the first breed upon which Bakewell, the great pioneer breeder of farm live stock, began his experiments in the improving of cattle. Those experiments were begun as early as 1755, and from that year dates the breeding of farm live stock in this country upon scientific principles.

The Long-horned cattle at one time existed in large numbers throughout England, chiefly in the Midland counties. They were also introduced into Ireland, but long ago they have been supplanted at one point after another by the Shorthorns or some other variety, and now the last few remnants of the breed are to be found in the Midlands of England.

The Long-horns are big, long-bodied, rather ungainly cattle, with long drooping horns, which are often so shaped as to make it difficult for the animals to graze short pasture. The cows are fair milkers, and the bullocks attain great weight. In the general properties of rent-paying stock, they are surpassed by most other improved breeds. Yet, partly on account of the unique historic interest attached to the breed, one delights to know that it is still being maintained in all its purity and antique character by a few devoted breeders.

A portrait of a typical Long-horn bull is represented in Plate 35.

ORKNEY AND SHETLAND CATTLE.

The native cattle of the Shetland and Orkney Islands are quite distinct in character from the races in the mainland. They show a considerable resemblance to the Kerry cattle of Ireland, and, like these hardy animals, are well adapted to their surroundings.

They are small in size, and, as a rule, not of a high character. The true Shetland cow, however, is a fairly handsome animal of a dairy type, with fine brown mellow skin and silky hair. On the

poor scanty feeding which she generally obtains she gives a wonderfully rich yield of milk.

Fig. 703 represents a Shetland cow.

FOREIGN BREEDS OF CATTLE.

The foreign breeds of cattle best known in this country are those which occupy prominent positions on the continent of Europe. In these countries there are breeds and varieties of cattle almost without number. At the Paris International Exhibition of 1878 there was held the largest and most widely representative show of farm live stock that has ever taken place. In that display there were sixty-five distinctive races and sub-races of cattle, besides thirty different crosses. The United Kingdom claimed eleven of the breeds, winning the Champion Prize for the best group of beef-producing cattle with a group of the Aberdeen-Angus breed. The other breeds and crosses came from continental countries. France itself contributed close on thirty varieties, the most noted being the Norman, Flemish, Charolais, Limousin, and Brittany breeds.

Dutch or "Holstein-Friesian" cattle,

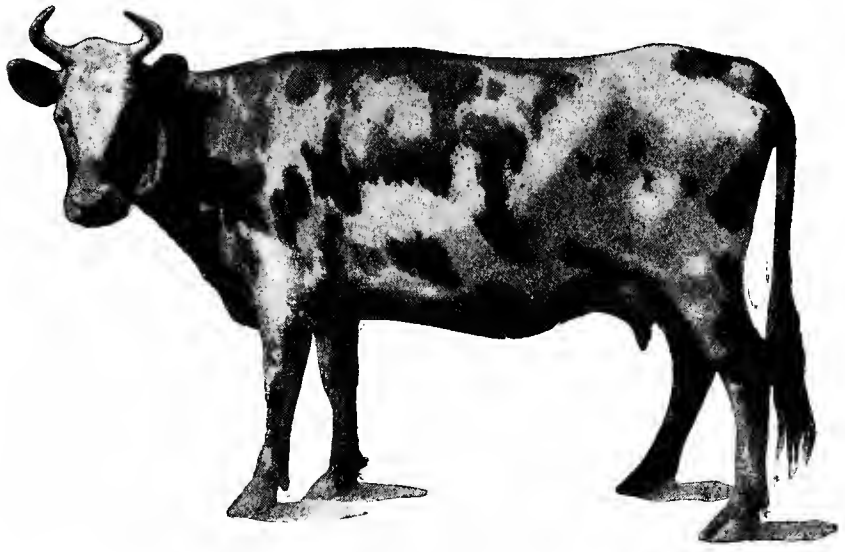


Fig. 703.—*Shetland cow.*

favourably known in this country and in America for their deep milking properties, were well represented at the Paris Exhibition, and so also were the cattle of Belgium, Denmark, Switzerland, Portugal, and Italy.

Polled Durhams in the United States.

A peculiarly interesting class of cattle in the United States of America is known as the "Polled Durham" breed. The cattle are in reality Shorthorns *minus* the horns. Some of the strains are pure-bred Shorthorns, descended directly from British-bred stock, the loss of the horns in these cases having apparently arisen originally through the exercise of nature's inherent power to give forth variety. Animals belonging to these strains are eligible for both the American Shorthorn Herd-Book and the American Polled Durham Herd-Book. Other strains of the polled breed trace from American native hornless cows, Shorthorn bulls being the sires continually used.

Polled Herefords.

Equally interesting is a tribe of polled Hereford cattle which has been established in Canada. Originating no doubt in a "spontaneous variation," the "hornless whitefaces" have been cultivated so skilfully that they now breed to the polled type with wonderful regularity.

LONG-WOOLLED BREEDS OF SHEEP.

THE LEICESTER SHEEP.

The Leicester sheep has been described as the parent long-wool. At one time it was commonly known as the Dishley sheep, and has probably occupied a larger space in ovine history than any other single breed. This is due to Bakewell's association with it.

Bakewell's Influence.

Bakewell's great influence in the history of live-stock improvement of this country first asserted itself towards the close of the eighteenth century. He began his life's work in the year 1755, and in the height of his success, some thirty years later, rented three Leicester rams for 1200 guineas. In the year 1789 he let seven rams for 2000 guineas, and in the same year the Dishley Society hired the remainder of his rams for 3000 guineas.

It is difficult to follow Bakewell's methods, for he was careful to let the public know little about them; but by his selection of big sheep, and having the eye of a genius for form and proportion, he undoubtedly brought the Leicester to its highest pinnacle of fame.

According to Culley, Bakewell began by making a tour of selection amongst neighbouring flocks. In Lincolnshire, which was not far removed from his farm, he had the assistance of Mr Stow of Long Broughton, who was the purchaser of many of his sires. Even in these early days, about 150 years ago, they were noted for their fine sheep in the Fen country; and that they were jealous of that reputation, the hire of one of Bakewell's tups for 1000 guineas by four Lincolnshire breeders for a season is more than *prima facie* evidence.

Culley, the authority already mentioned, expresses the opinion that prior to Bakewell's time there was no criterion in sheep but size. Before Bakewell's improvements, the description of the sheep then generally found is interesting "They had," says Culley, "a large hollow behind the shoulders, upon the top as well as the side, now known by the technical name fore flank, which in a fat sheep now not only fills up the former defect, but even projects beyond the shoulder and gives a great roundness to the form of the carcass."

There was a great air of mystery about Bakewell's improvement of the Leicester. In these days of Flock-Books and public registration, no doubt many of his methods would be condemned, though the results of his handiwork were undeniably successful. He was supposed to have a black ram in the background for one thing. Sir John Sebright was moved to protest in the *Farmer's Magazine* of 1827 against "the mystery with which he [Bakewell] is well known to have carried on his business. The various ways which he employed to mislead the public induce me not to give that weight to his assertion which I should do to his real opinion could it have been ascertained."

Then the Bakewell Ram Club consisted of twelve members pledged to absolute secrecy. One of the conditions was that "the much dreaded members of the Lincolnshire Society should not have a ram unless four joined and paid 200 guineas for him."

Youatt, in his well-known volume, says that Bakewell selected sheep "of the most perfect symmetry with the greatest aptitude to fatten, and rather smaller in size than the sheep then generally bred." He did not object to use "near relatives." Referring to the supposition that Bakewell created the new Leicester by crossing different "sorts of sheep," Youatt remarks, "There does not appear to be any reason for believing this, and the circumstances of the new Leicesters varying in their appearance and qualities so much as they do from the other varieties of long-woolled sheep can by no means be considered as proving that such was the system which he adopted."

Locality.

The Leicester is chiefly found in the more northerly parts of England, on the bleak wolds of Yorkshire. There they feed very quickly, and have the constitutional stamina to resist the inclement weather to which they are so freely exposed.

Characteristics.

In appearance the Leicester sheep has a bold head and the rams are slightly Roman-nosed. The head is broad at the poll, which is sometimes covered with a forelock and sometimes not. The lips and nose are black. The back is broad and level, the breast deep and wide, carrying a full bosom. A good sheep must be deep through the heart, the ribs being well-sprung, the loins wide, and the dock carried level with the spine. The fleece, which is a valuable portion of the sheep, should be free from black hairs. The sheep should stand squarely, with a leg at every corner.

In the Flock-Book Mr Joseph Crust writes as follows: "The Leicester has during the last few years made rapid strides towards perfection. . . . By continuous and judicious crossing with other sires of large size and heavy fleeces, a class of sheep has been produced of corresponding proportions, with a fulness of wool, yet retaining the original propensity to fatten. They are hardy and well adapted for any climate and soil, during the severe winter months being folded on turnips in the open fields on the bleak wolds of Yorkshire, where they feed quicker than any other class of sheep that have been wintered in the same situation, requiring less artificial food, and suffering a minimum proportion of loss; they are also remarkably sound in their feet, being seldom attacked with foot-rot."

Clip and Weight.

The Leicester is known to clip and weigh well. It is not surprising to learn that fleeces of 21 lb. to 28 lb. of washed wool from rams are not uncommon. A good flock average would be about 12 lb. The breed attains to heavy weights up to 240 lb. As long ago as 1793 a ewe at Mr Paget's sale, in Leicestershire, scaled 36 lb. per quarter. She had 16½ lb. rough fat, and including the offal weighed 177½ lb.

For Crossing.—The Leicester has in the past been particularly favoured by colonial and foreign buyers for crossing purposes. Its aptitude to fatten is a strong point in its favour. In New Zealand the rams are highly esteemed in the production of freezers. They are also much used as ordinary commercial sheep in the north of England, where their freedom from foot-rot enables them to do well in rough country.

It would be ungracious not to recognise the part played by the Leicester in the improvement of other breeds. From the time that Bakewell gave it a preponderating influence in the work of English sheep-breeding, it has been used in the evolution of the present-day type of the following breeds: Lincoln, Wensleydale, Kent or Romney Marsh, Border Leicester, South Devon, Devon Longwool, and Cotswold.

MANAGEMENT OF LEICESTERS.

In Leicester flocks the system of management is exceptionally systematic and skilful. The method of feeding is liberal, and this is well justified by the yields of wool and mutton obtained from the breed. The general practice in the leading flocks is well indicated by the following notes received from Mr T. H. Hutchinson, Manor House, Catterick, Yorkshire, who has long maintained a very celebrated flock of the genuine old English Leicesters:—

"I keep a flock of pure-bred Leicesters, which I find to answer my purpose better than any other breed. My aim is to produce as much wool and mutton as possible from the produce of my farm, and to keep the land in a very high state of cultivation.

"I annually put 200 ewes to the ram, and generally average about 1½ lambs to a ewe. The ewes are put to the ram in the last week in September.

"Besides the lambs I breed, I buy from 150 to 250 to 'turnip' during the winter. As I cannot buy pure Leicesters, I generally buy 'north' lambs—that is, lambs bred from Cheviot ewes with three crosses of the Border Leicester. These do re-

markably well on turnips, and go off fat in February and March, weighing from 16 lb. to 22 lb. per quarter.

Feeding of Ewes.—"The ewes run on the grass in autumn, and have roots with cut oat-sheaves given in addition before lambing, also hay if I can spare it. After lambing, the ewes get roots with a mixture of malt-combs, linseed-cake, bran, oats, and cut hay, until the pastures are good enough to keep them going.

Feeding Lambs.—"The lambs are weaned in July either on to some after-grass or good old pastures, until cabbages or thousand-headed kale are ready. After that they go on to Fosterton Hybrid turnips, then finish on the swedes. As soon as the lambs go upon cabbage, &c., they are allowed a mixture of crushed tail corn, linseed-cake, malt-combs, bran, &c., made into a kind of lamb-food. I prefer a mixture to cake alone. When put upon turnips the roots are all cut, the turnips all being stored in October and early part of November. Hay and straw are also given. I find nothing like plenty of dry food for sheep on turnips.

"A piece of rock-salt should always be kept in a trough, for the sheep to go to when they like.

"The lambs and ewes are all dipped after clipping, and again in autumn.

"The rams for show purposes are kept as well as possible, and get the best of everything likely to do them good.

"You ask me what quantity of turnips or other food should be consumed per day. I am sorry to say I cannot tell you. I always let the sheep have plenty to go to, and fancy they are better judges than I am as to the quantity they require; at any rate, I leave it to them to decide."

Gainford Hall Flock.

In Mr George Harrison's well-known flock of Leicesters at Gainford Hall, Darlington, lambs are dropped in March and weaned in July. For some time before weaning the lambs get a mixture of cake and oats in a pen from which the ewes are excluded. After weaning this mixture is continued to the lambs on clover or other foggage. A number of fat lambs are sold for killing in June, July, and August, the prices ranging from 35s. to 40s. each. Fat hoggets are sold in the following January at from 50s. to 60s. each.

Ram breeding is a special feature in Mr Harrison's flock. He sells ram lambs in September and October for the getting of lambs for early fattening. He also sells a number of shearling rams for stud purposes. Young rams are put on clover, thousand-headed kale, cabbages, turnips, and swedes in succession, and get a mixture of cake and corn in addition. This flock has taken a leading position in showyards, and rams for it find their way not only to all parts of this country where Leicesters are kept, but also to many foreign lands, including New Zealand, Australia, Tasmania, France, Denmark, and South America.

During the winter the ewes in this flock get plenty of good hay, a run on grass, and a few roots after Christmas; after lambing, for about a month or six weeks, they get a mixture of cake and oats with plenty of roots. During the other parts of the year the ewes depend entirely on grass. They drop their first lamb when they are one year old.

A portrait of a Leicester ram is given in Plate 50.

BORDER LEICESTERS.

It is only since about the year 1860 that the Border Leicester breed of sheep has been known by this name. Prior to that, although its distinct characteristics had become well established, it was classed along with the English sheep descended from the same source, and termed the Leicester, or the Improved Leicester. The Border and the English Leicesters were so widely different in their form and wool, that it became impossible they could compete satisfactorily in the same classes, as the judges in the showyards, however carefully chosen, could not be otherwise than biassed. When the majority happened to be breeders of the English variety, the premiums went very naturally to the type they favoured, and *vice versâ*. If the judges were solely on one side, then a grave injustice followed. The position became the more acute as in the course

of time the differences apparent in the two varieties widened; and at length it was found necessary to have distinct classes for the variety under notice, which has since been known as the Border Leicester. Down to 1868, all Leicesters, whether from the Midlands of England or the Border counties, were forced to compete in the same classes at the shows of the Royal Agricultural Society of England; but next year, at the Manchester meeting, they were divided as in Scotland.

Origin—Bakewell's Improvements.

Both varieties had their origin at Dishley, near Loughborough, where Mr Robert Bakewell began to improve the sheep he found around him in or about 1755. The precise method adopted by Bakewell is unknown, as a certainty. It is believed by some that he crossed the sheep of his shire of Leicester—"said to have been large coarse animals, with an abundance of fleece and a fair disposition to fatten"—with other long-woolled breeds, probably possessing smaller frames and more symmetrical proportions. Another and highly probable theory is, that without going beyond the sheep at his hand, he boldly adopted this material, and by breeding from selected animals of close affinities, and continuing this system as far as was advisable, he managed to establish a distinct breed, the main characteristics of which were large yet symmetrical frames, carrying heavy flesh upon fine bone; decided aptitude to fatten upon a moderate quantity of food; and capable of being brought early to maturity, while bearing a fleece of large weight and superior quality.

It is evident that the materials which Bakewell used must have been very plastic, since his improvements were quick in displaying themselves. So early as 1760 he commenced letting his rams for a guinea for the season's use. The reputation of the Dishley flock increased by "leaps and bounds," rising to such a pitch that twenty years after he commenced to let rams, Bakewell received no less than £3000 in hire fees in a single season. In 1789 it is stated that he netted £6000 by the letting of his tups. So general was the rush for improvement in sheep stock about this time that it was computed no less than £100,000 were annually spent by Midland agriculturists in procuring sires. Large although this sum is, it is not altogether improbable, considering that in 1789 Bakewell received from £1000 downwards for the season's use of a single ram.

Such being the condition of sheep-breeding in the Midlands, it need not be marvelled at that agriculturists in far off shires, even in those days of slow, tedious, and imperfect communication, should have desired to share in the results which others had accomplished.

Messrs Culley's Flocks.

When Bakewell commenced his improvements, two brothers, George and Matthew Culley, were farming at Denton, not very far from Darlington. In 1762 and 1763 the brothers visited and became intimate with Bakewell, and from Dishley they brought rams with which they crossed the native Teeswater sheep, which then stood in high favour as a long-woolled breed. Proceeding in this manner, they were not long in forming a flock of their own, which was transferred to North Northumberland in 1767, and they took farm after farm until they paid an aggregate rental of about £6000 a-year. After having bred sheep in North Northumberland for nearly forty years the Culleys retired in 1806, when their sheep were sold off.

Other Early Improvers.

Mr Robert Thomson, who, like one of the Culleys, had been a pupil with Bakewell, also took a leading part in the introduction of the breed. He farmed at Lilburn, and afterwards at Chillingham Barns; and his flock, long known as one of the very best on the Borders, was bred directly from Bakewell's. It was at Lilburn that the first sale by auction of Bakewell sheep took place in the north. At Chillingham Barns Mr Thomson held annual lettings, and there, in May 1814, his entire flock was dispersed.

A part of Mr R. Thomson's flock passed into the possession of Mr James Thomson, Bogend, Duns, who had also formerly obtained rams from the Culleys and from Chillingham Barns; and it may

be stated that this flock was until comparatively recently still in existence, being owned by Mr James Thomson, Mungo's Walls, a grandson of the tenant of Bogend. Having been bred by the Thomsons for upwards of a century, the Mungo's Walls flock formed the most perfect connection between the time of Bakewell and the present day in the history of the breed. It seems there were in Bakewell's flock two types of sheep, known as "blue-caps" and "red-legs," the latter being much the hardier of the two; and from what the writer has been able to learn Mr Thomson's sheep were of this hardier sort.

Rams from the flocks of the Culleys and Mr Thomson must have been very early and very generally used in the district around them as well as north of the Tweed, since flocks had multiplied to a wonderful extent at the time of the dispersion of the Culley sheep. Whether these other breeders obtained ewes of the improved breed or "bred in" from the ordinary country stock with Dishley rams it is difficult to determine satisfactorily at the present day. Yet this question affects the purity of the breed in later times to a grave extent, and certainly gives weight to the prevalent impression that there is much Cheviot blood in the Border Leicester. It is next to an impossibility that all of the Tweedside, Glendale, and "Barmshire" breeders could have obtained their stock ewes and gimmers from Thomson and the Culleys so quickly and to the extent necessary to account for the size and number of the flocks in 1806. Besides, these pioneer breeders were chary of parting with females.

The subject is a difficult one to treat of satisfactorily, and is referred to here only in a suggestive way. One thing is most evident: that flocks of "improved Leicesters," whether pure—relative though the term may be—or not, sprang up, like the proverbial mushrooms, in North Northumberland, from which they quickly spread into Berwickshire and Roxburghshire.

In later years the breed has spread widely over Scotland, and although the counties of Roxburgh and Berwick may still be said to be the headquarters of the breed, Border Leicesters are bred as successfully in the north as in the south. Indeed, the late Mr David Hume, whose flock was located in Forfarshire, was invincible for several years for shearling rams at the annual shows of the Highland and Agricultural Society. There are also very good flocks of the breed as far north as Ross-shire, and even in the county of Caithness.

The Mertoun Flock.

To a large extent the history of the Mertoun flock is the history of the breed, in Scotland at any rate. It was founded by Mr Hugh Scott of Harden, grandfather of the present Lord Polwarth, in 1802, and for over forty years was entirely a self-supporting flock, not a single animal, male or female, having been introduced from any other flock during all that time. The system on which Lord Polwarth worked was to carefully select animals from the different strains of blood existing in his flock and mate them together on prearranged lines, and in this way it was possible, not only to minimise the risks of in-and-in-breeding, but at the same time to secure a uniformity of type and character in the flock that could hardly have been obtained in so large a measure by any other method of breeding.

Lord Polwarth was careful to note the breeding qualities of rams which were bought from the flock, and never hesitated, whatever the price asked, to buy back for use in the parental flock any ram which bred specially well and which seemed likely to be of advantage in the flock. Sheep brought back in this way, it was thought, answered to a certain extent the same purpose as introducing new blood, for their stay for some time under different conditions as to soil and climate was believed to have an effect upon them which enabled them to exercise a reinvigorating influence upon the parent stock.

There is no doubt this system was very successful for a long period of time. Towards the close of the last century few breeders of Border Leicesters considered their flock properly equipped without a "Polwarth" ram as principal sire. Many first-class breeders would hardly buy anything else for ram-breeding purposes. At that time Lord Pol-

warth was accustomed to get very high prices for his annual draft of tups sold at Kelso, thirty sold in 1890 realising within a few pence of £54 per head, while one sold at £155. A few years later one very fine ram was sold to Mr Lee of Congalton for £275, which up to 1907 was the record price for a ram of the breed.

Since the advent of the present century other breeders have been getting a larger share of patronage from buyers of high-class rams for stud purposes. The Mertoun flock continues to show the remarkable gaiety and strong family likeness which so long characterised it, but there are those who incline to the belief that it would be benefited by the infusion of fresh blood.

Other Noted Breeders.

The rising popularity of a considerable number of other flocks of Border Leicesters has been a gratifying feature of the Kelso ram sales in recent years. At these sales in 1907, Mr Matthew Templeton, who is a tenant on the Mertoun estate, obtained an average of £40, 5s. for each of his best "cut" of twenty-five shearling rams, one ram bringing £160. On the same occasion Messrs Smith, Leaston, Upper Keith, received an average of £35, 13s. for each of eight shearling rams, one of these rams breaking all previous "records" by realising the handsome sum of £280, the buyer being a New Zealand flockmaster. Another ram from the same flock was sold for £200 in 1908. It is much to the advantage of all interested in the breed that so many flocks of it of the highest character and quality exist throughout the country.

Characteristics.

As already stated, there were two families in Bakewell's flock, the "blue-caps" and "red-legs." Formerly "blue-caps" were pretty common on the Border, but for a long period the "red-legs," owing to their greater hardiness, have held possession. Their representatives of the present day are admirably described by Mr John Usher, in *The Border Breeds of Sheep*, thus: "The head of fair size, with profile slightly aquiline, tapering to the muzzle, but with strength of jaw, and wide nostril; the eyes full and bright, showing both docility and courage; the ears of fair size and well set; the neck thick at the base, with good neck vein, and tapering gracefully to where it joins the head, which should stand well up; the chest broad, deep, and well forward, descending from the neck in a perpendicular line; the shoulders broad and open, but showing no coarse points; from where the neck and shoulders join to the rump, should describe a straight line, the rump being fully developed; in both arms and thighs the flesh well let down to the knees and hocks; the ribs well sprung from the backbone in a fine circular arch, and more distinguished by width than depth, showing a tendency to carry the mutton high, and with belly straight, significant of small offal; the legs straight with a fair amount of bone, clean and fine, free from any tuftiness of wool, and of a uniform whiteness with the face and ears. The sheep ought to be well clad all over, the belly not excepted, with wool of a medium texture, with an open pirl, as it is called, towards the end. In handling, the bones should be all covered; and particularly along the back and quarters (which should be lengthy) there should be a uniform covering of flesh, not pulpy, but firm and muscular. The wool, especially on the ribs, should fill the hand well."

Mr Usher's description is still generally accepted as on the whole accurate. No doubt many of the best sheep in most flocks are occasionally flesh-coloured in the muzzle, but it is regarded as an evidence of hardiness to have it perfectly black; therefore in any general description this point ought to be emphasised. The ears should be of moderate length, and boldly set, but thickness, even at the base, in shearling rams as well as in ewes should be a disqualification. Again, the ear should neither be too much flesh-coloured, nor blue nor purple. A darkish —not a brownish—skin, covered with fine white hair, is most to be preferred, although black spots, when distinct and separated from each other, are not at all objectionable. Then the face should be covered with short white hair; and on no account should there be any blueness. Corded or scored faces are specially to be

avoided in females and shearling rams. These are considerations of primary importance. The legs, from where the wool ceases to grow, should be covered with short white hair; the "cluits" should be black, and the pasterns as upright as possible.

The "blue-caps" of by-past times have been described by the late Mr John Grey, Dilston, as having "blue faces, generally bare on the scalp, and red when lambed; and when mature, easily broken by flies; on which account they were not favourites with the shepherds. They were good feeders, but light of wool." It is evident that what are now termed English Leicesters are the representatives of this Bakewell family, although time has both modified and accentuated their former characteristics. The English sheep is not such a large-framed sheep as the Border Leicester, and is considerably shorter in both neck and legs; but it is much more compact, wider through the heart, and heavier in front in proportion to its size. It is also a much deeper sheep, and carries a heavier fleece. The bone, too, is finer, and the amount of mutton yielded, size considered, is greater than that usually carried by the Border Leicester.

Value for Crossing.

Except as ram-breeding flocks, Border Leicesters are not now kept to the same extent as they formerly were, the mutton being too coarse in its texture, and the fat too much of the consistence of tallow to be put to a profitable use, or please the palate. These are drawbacks to the general utility of a breed which has few rivals in reaching early maturity, and which produces a great weight of mutton and wool in a given time. Its outstanding merit lies in its pre-eminent suitability for crossing with the Cheviot, Blackface, and other varieties. The cross with the Cheviot is the most popular, the produce being the Half-bred variety now largely reared. On most turnip and grain farms a stock of Half-bred ewes are kept, which being again crossed with the Border Leicester ram, produce three-parts-bred lambs. These quickly develop, and being fed at high pressure, are generally in the fat market before they are a year old.

MANAGEMENT IN BORDER LEICESTER FLOCKS.

Leaston Flock.

The management of Border Leicester flocks follows fairly general lines. In the well-known flock of Messrs A. & J. K. Smith at Leaston, Upper Keith, lambing takes place, as a rule, from the 12th of March to the end of April. Weaning takes place about the beginning of August. Single lambs before weaning get no extra feeding; twins get about ¼ lb. of a mixture of compound cake, bruised oats, and locust-meal. After weaning ram lambs are put on clean pasture or foggage, and the extra food continued. In addition they get cut tares daily to begin with, followed by cabbages, white turnips, and yellow turnips, as they are in season. Ewe lambs are also put on clean grass after being weaned. No box food is given in the case of the ewe lambs, although they may get a few cabbages and then turnips.

Rams are sold as shearlings in September and October at from £4, 10s. upwards, one, as already stated, having brought £280 in 1907. Surplus gimmers are sold in September at from £3 to £10 per head, and cast ewes in October at from £4 to £5 also per head.

Ewes after being settled to the tup are kept on rough pasture until the middle of December—sometimes till the end of the month. Then they get five hours daily on turnips, with a run off on a grass field, and as much hay as they can eat. If the frost should be hard fresh turnips are laid out daily on the pasture. Nothing in the owner's experience is worse for in-lamb ewes than frosted turnips. At Leaston box-feeding is begun ten days before lambing, the practice being to give 1 lb. each of a mixture consisting of bran, oats, and compound cake. Ewes with single lambs get no extra feeding after lambing. Ewes with twins are fed up to the end of May with the mixture already mentioned.

Lambs about this time are shed off from the ewes every morning and get their extra feed. As a rule, a corner

of the field is railed off for this purpose. With this exception grass is the staple food all through the summer. Good breeding ewes are sometimes retained in the flock until they are ten years of age.

The ram lambs are fed on yellow turnips, and get the concentrated food already mentioned up to about the middle of February, when they get swedes. The concentrated food is also changed at this time to a mixture of linseed-cake, bran, bruised oats, and locust-meal. All through the winter the young animals get the best of hay, and have access to rock-salt, getting also a little common salt in their concentrated food. As soon as young grass is ready they are put upon it. Tares are begun about the middle of June, and cabbages in August. Sometimes thousand-headed kale is used. The extra food is increased daily, bran being stopped on grass, and peas and Bombay cotton-cake substituted.

A Border Leicester flock requires very careful attention, and involves much hard work, especially where considerable numbers of rams are turned out annually. The annual output of these from Leaston is about two hundred. A close study has to be made of the mating of the ewes to suit the different rams. When a ram is bought he is not given many ewes the first year, but his produce is carefully watched, and ewes drawn to suit him for the following year. Messrs Smith like to run their pure-bred sheep thinly over the pastures. No class of sheep, in their experience, do well heavily stocked.

Galalaw Flock.

Lambing in the Galalaw flock, belonging to Messrs J. & J. R. C. Smith, takes place in March and on to the middle of April, the lambs being weaned in the latter half of July. During summer the lambs get a little box-feeding—lamb-food not more than ¼ lb. daily, the lambs being run off from their mother for this purpose. After weaning they go for three weeks on clean old grass, and have the box-feeding continued. The ram lambs are carried on to the shearling stage and then disposed of at Kelso, prices running from £5 upwards, the highest being £150 per head. Ewe lambs are drawn in the spring, when they weigh from 18 to 20 lb. per quarter. Those not required for breeding purposes are sold at about 8d. per lb. as a rule.

The ewes in this flock get ten weeks turnips before lambing, and a little box-feeding and hay as lambing time approaches. The box-feeding is continued until June. Ewes with twin lambs get young grass; those with singles the two-year-old grass. After weaning ewes are all the better of a change off the farm to higher-lying land if possible. They return to their own pastures a few weeks before the tups go out. This change helps to ensure a good crop of lambs, and admits of the cleaning up of the home ground.

Ewes have their first lamb at two years old, and may either go on for four or five years or be cast at two and a half, as the appearance of the ewe or her produce warrants.

Ram lambs are brought through the autumn on seeds, with tares (if available) or cabbage. Hay foggage is valuable, but not always easy to get. In November they go on to turnips, and get cut turnips, hay, and a little box-feeding during winter. The sooner they get young grass in the spring the better; and they depend upon it, with tares in addition as the sales draw near. Any change of food is made gradually, and surfeiting is avoided. Stock rams are kept among the ewes, except for two months before tupping time, when they are kept by themselves, and get a little extra keep in the way of box-feeding.

Pictstonhill Flock.

In Mr W. S. Ferguson's flock at Pictstonhill ewes are kept from the end of May until August with their lambs on nothing but grass. The lambs are weaned in August, and ewes go on the grass fields until the following March, when they are taken in to lamb. In an open winter the ewes require little more than they pick up, but when frost and snow prevail they get a small quantity of turnips daily (not *ad lib.*) and hay. If the snow continues long 1 lb. of oats and cake per day is given. When turnips are scarce, oats, cake, and hay bring them through the winter quite as well as, if

not better than, roots, but at greater cost.

At Pictstonhill the ewes lamb in March and April. A large lambing shed is available, but is used as little as possible; sheltered fields and dyke-sides are better if the weather be at all favourable. The ewes after lambing are liberally hand-fed to keep them in milk, the quantity of food varying with the weather. Cut turnips, mostly yellows, are given. The time turnips are given and the quantities depend entirely on the spring and the grass. Nothing in Mr Ferguson's experience will put ewes and lambs into sound health and thriving condition like the first flush of young grass.

The ewes and lambs get a little hand-feeding until about the middle of May; after that, grass and nothing else. When lambs are weaned they get the best of the grass, cabbages, and ½ lb. of hand-feeding. When ram and ewe lambs are separated in September the rams are continued on cabbages, turnips, and grass, along with the ½ lb. of hand-feeding, while the ewe lambs get the run of grass, and if turnips are added the cake is taken away. About 1st December the rams are generally folded on turnip land for the winter and cut turnips fed to them in boxes, and hay given. The hand-feeding may be increased to 1 lb. a-day, but more is seldom given at any time except for a month before the September sales, when the allowance is doubled if the rams will take it. They get some cut tares on the grass in July and August, but only if the grass is insufficient.

Rams in summer have always to gather their food, and so make them muscular and active. If all the food is taken to a Border Leicester ram so that he can lie and feed and sleep at grass in summer, Mr Ferguson thinks that it is all the worse for the man who buys him. At Pictstonhill rams are never housed except in rough days in early spring after clipping. The owner is strongly of opinion that the modern artificial bloom put on rams for sale through house-feeding is doing harm to the breed. It was never done in the old days. This, however, does not apply to the few animals drawn out for show-training, but even with these the practice at Pictstonhill has generally been to walk the sheep on a hard road for at least a quarter of a mile to a bit of pasture every good day.

Oldhamstocks Flock.

In Messrs Clark's old-established flock at Oldhamstocks, Cockburnspath, lambing begins, as a rule, about the 1st of March, and the lambs are weaned in the beginning of August. From the beginning of December the ewes in this flock are allowed every day a cart-load of white turnips to every seventy, and about ½ lb. each per day of cake and oats. As soon as the turnips are finished ewes with double lambs get an extra allowance of the artificial food. After weaning the ewes are put for the first fortnight on to the poorest pasture on the farm. A few weeks before the tups are let out they are put on to better pasture.

Messrs Clark feed a considerable number of half-bred lambs which they buy in August. In addition to turnips the lambs are allowed daily about ¼ lb. of cake and oats. The lambs are generally sold about the end of May in the following year as soon as they are clipped. The better half of them by this time will run from 80 to 100 lb. of mutton per carcase, and they realise about 50s.—fully 10s. per head less than they fetched a few years ago.

Females of the pure-bred flock have their first lamb when about two years old. They are usually cast about five years old. When the tup lambs are weaned in the beginning of August they are put on to foggage if there be any on the farm. If not, they get tares on a clean pasture. Whenever the turnips are ready they get a few of these, bringing them gradually on to as many as they will eat, with an allowance of cake. Stock rams on the farm receive no extra feeding except when at service.

Deuchrie Flock.

Mr Jeffrey at Deuchrie, Prestonkirk, has the lambs arriving from the second week of March onwards. They are weaned about the beginning of August. Twin lambs get a little lamb-food before weaning; single lambs nothing but the milk and grass. After being weaned the tup lambs are put on foggage if there be

any available. Ewe lambs are kept on first-year's grass.

Shotts of the tup lambs are sold in spring in the fat market, making, in 1908, 53s. The others are kept on until shearlings and sold at the Kelso, Edinburgh, and Lockerbie sales. Ewe lambs are drawn at the same time as the tup lambs, and the best only kept for breeding purposes.

Ewes before lambing are generally on turnips for several hours every day, and run off on to heather at night. When nursing they are grazed in the fields, getting about ¾ lb. each of some feeding mixture, not always the same. When the lambs are weaned the ewes are turned on to the hill or poor pasture, and are brought in a week or two before the tups are put out. Ewes, as a rule, have their first lamb at two years old, and they are cast after having four crops.

Young rams are managed as ordinary feeding sheep until clipping time, after which they are allowed some extras in the way of green tares and cabbages in preparation for the ram sales. Stock rams are generally wintered among the ewes, and do not call for special care, as they generally get fat enough without any extra feeding.

Whittingehame Flock.

In the Whittingehame flock of Border Leicesters, belonging to the Right Hon. A. J. Balfour, M.P., lambs are dropped between 15th February and 1st April. No extra food is given to the lambs before weaning. Before lambing the ewes get yellow turnips and straw; after lambing, swedes, with a mixture of cake, bran, and oats until pasture grass is ready.

After weaning, about the end of July, the ram lambs to be kept for breeding purposes are put on to young grass, where they get cake, or a mixture of cake, Indian corn, and bran. This mixture is continued until September of the following year,—about 1 lb. per day is the full quanity, but less is given at first. In winter, when the pasture is done, the young rams get turnips and hay.

PREPARING RAMS FOR SALE.

Messrs Smith, Leaston, have been good enough to supply the following information regarding their method of preparing Border Leicester rams for sale. They begin clipping about the 1st of April. All new wool is left on, but on no account do they leave old wool. Sheep are never washed when newly clipped. The grease that there is in the wool makes the sheep less liable to catch cold. The animals are kept in a well-ventilated dry shed, and are let out for a run daily. When warmer weather comes, say about the middle of May, the sheep are washed with soap and water and made to swim through cold water. When dry and coats thoroughly set, the sheep are dressed all over. In a week's time they are dipped with fairly strong dip, which helps the growth of the wool.

Nothing more is done until the second week in July, when the rams are again washed. Great care must be taken not to rub out the curl in the wool; indeed, they should not be rubbed at all—just clapped with the hand. When the coat is set (a full week is usually given) dressing is again done. This is the most important dressing of the year. Backs are well taken down, coats squared out at the rump, tails dressed to set off quarters, wool left full between hind legs, necks close taken in and tapered off to front of breast. The sheep are then dipped again in strong dip. Care is taken not to let the sheep out in strong sun for a few days after.

As the sales come on generally in the second week in September, the next washing, &c., is done two weeks before. This time dipping is done before washing, this being to give the sheep a nice rich bloom after they are washed. They are again washed a week before the sales, and carefully gone over with a pair of shears. Care is taken to show the sheep in first-class bloom, but it is very difficult to do, especially if the weather be wet and when such large numbers have to be dealt with.

The rams' heads are capped during the later part of summer. This helps to prevent them fighting, and also keeps away the flies. In very hot weather they are sometimes kept in the house during the day and let out at nights—the select lot at any rate. The Leaston sheep are carefully classed to suit the different markets. The best breeders'

sheep are sold at Kelso—viz., those with nice curly wool, well covered white heads, well-set ears, strong loins, stylish walkers, with good flat bones. For Edinburgh the rams are of the same style, but closer in coats, as most are sold for crossing with Cheviot ewes for breeding half-bred lambs. The rams for the Perth sales must have very strong curly coats; the character of the head is not so important, as the Perth rams are used for crossing with Blackface ewes. Sheep used for this purpose must be active on their legs. The remainder are sold privately at home.

A portrait of a Border Leicester ram is given in Plate 50.

THE LINCOLN LONG-WOOL.

The Lincoln Long-wool sheep is native to the county from which it takes its name. It is one of the oldest of our breeds, being known in Lincolnshire for upwards of 150 years. Many of the chief flocks are, so to speak, family heirlooms handed down from one generation to another.

Lincolnshire has always been noted for the size of its stock. It produced the Fen type of Shire horse, the red variety of Shorthorn cattle, the Long-wool sheep, and the curly-coated pig—every one of which stands out in respect of size and substance.

Doubtless, in the earlier days, the Leicester was employed to get fleece and form; but not a few hold that the Leicester is much indebted to the Lincoln, yet perhaps not so much as the Lincoln to the Leicester.

Noted Early Flocks.

There are records in existence tracing the descent of flocks in the present day as far back as 160 years. Thus Mr J. E. Casswell's flock at Laughton, Folkingham has been in the hands of the family since 1740, and that of Mr Tom Casswell at Pointon since 1755. Other well-known flocks can claim almost as ancient a record—notably that of Mr Henry Dudding at Riby Grove, which for so many years was maintained by his father at Panton. The names of Clarke, Kirkham, Needham, Smith, Cartwright, Howard, and Wright, are prominently identified with the development of the Lincoln sheep. It is interesting to note that Mr Henry Dudding's grandfather was one of four who hired a Bakewell ram for a season at the record price of 1000 guineas.

In the olden days ram-lettings were great institutions, but in modern times they have been superseded by auction sales. As far back as 1837 Mr G. Casswell, the grandfather of Mr J. E. Casswell, let a ram for £90. The averages made in the middle of last century indicate that the very high prices paid in recent years are founded on a long period of high figures. In the old Biscathorpe flock (Mr Kirkham), for instance, the average of 150 sheep in 1864 was £22, 12s. 4d. This flock also averaged in 1872 £25, 11s. 6d. for 120 head; while in 1873 the average was £35, 17s. 7d. for 70 sheep.

Modern Records.

All previous records, of course, sink into insignificance before the 1450 guinea sheep at Mr Dudding's sale in 1906. That sheep was purchased for the Argentine. Mr Dudding has on two other occasions realised 1000 guineas for a single ram, and in the year 1907 the top figure at his auction was 900 guineas. In 1906 Messrs Wright of Nocton Heath, Lincoln, sold their flock to be exported to the Argentine. The buyer was Señor Cobo, and the total sum paid is said to have been in the neighbourhood of £40,000.

Characteristics.

The Lincoln is a big, bold type of Long-wool. One of its chief sources of value is its matchless fleece. A sheep of fine symmetry, it carries a strong head on a thick neck. The ears should be wide set and carried forward. The eye should be bold, the nostrils broad in the ram, and the muzzle shapely. There should be no spots on a white face. The sheep should stand squarely, be broad in the back, with no weakness of rib to be detected under hand. The rump and loin should be well filled, and the dock carried high. A low-set dock is a sign of weakness. The leg of mutton should be full—a point in which defect is

most frequently seen. The limbs should be white—a grey leg being a bad fault.

The fleece should be as nearly as possible of one quality all over the body, and extend down to the hoofs behind. The staple is very broad and wavy. A shearling will sometimes grow locks of close on 2 feet long. The cod should be well covered, otherwise there is likely to be a scarcity of belly wool. The forelock is a strong point in a show sheep.

Clip and Weight.—There are instances on record of exceptional clips, such as 32 lb. of washed wool. Well-grown rams commonly clip 25 lb. of washed wool. Probably the best flocks will average 14 lb. of wool, though 12 to 13 lb. is a good figure.

Mr Henry Smith, jun., of Cropwell Butler, Nottingham, says that "a flock of well-bred ewe hoggets will yield a stone of wool each; rams much more. I believe that the 350 guinea ram sold by Mr John Pears in 1896 to Messrs Kirkham of Biscathorpe and Cartwright of Keddington clipped 31 lb. This was an unusual weight certainly, but many go over 20 lb."

The breed is the heaviest in England. It has produced phenomenal weights at Smithfield. Mention might be made of the winning pen of three wethers in 1907, which weighed 10 cwt. 6 lb at 21 months 3 weeks and 4 days. An analysis of Smithfield weights shows that the average gain of lambs in live-weight is about 11¼ ounces daily, though it is sometimes as high as 12¾ ounces. The wethers gain about 8¼ ounces, the best turning 9 ounces daily.

Mr Henry Smith, jun., writing of his champion pen in 1896, says that they averaged 219 lb. when dressed, and the butcher reported that they were "very good fleshed sheep."

Early Maturity.—The breed is very free from foot-rot and matures early. Sheep of the Lincoln type are kept largely for crossing purposes, the Down cross being much favoured.

Constitution.—A strong point is made of the constitution of the Lincoln sheep. It is kept in a natural state, although the show specimens are brought out in a condition of obesity. In winter the flock makes its living on turnips.

Foreign Trade.—Without the foreign demand the Lincoln flockmaster could not boast of high prices. Several breeders are their own exporters, but most of the business in high-priced sheep is done through agents. At the present time the Argentine is the chief market, although in former years New Zealand and Australia were splendid customers. As indicative of the strength of the demand, it may be mentioned that the Lincoln Long-wool Sheep Breeders' Association, founded as late as 1892, issued in 1905 4855 export certificates. In 1906 the number was 6928, and in 1907 3566.

MANAGEMENT OF LINCOLN FLOCKS.

The management of Lincoln flocks does not vary greatly in the leading flocks. As befitting sheep of large size, carrying exceptionally heavy fleeces of wool, the system of feeding is liberal in all successful flocks.

Cropwell Butler Flock.

In Mr Smith's celebrated flock of Lincoln sheep at Cropwell Butler, near Nottingham, the majority of the lambs are dropped in the month of February. The ewes are kept on pastures till about Christmas. On the approach of bad weather they are given in troughs a mixture of different foods, such as cotton-cake, oats, offal peas, and barley, with as much chopped straw as they care to eat, additional fodder being supplied in racks. Between Christmas and lambing time the ewes get white turnips or kohl-rabi, with plenty dry food. After lambing they go on to good pasture, and get mangels with some extra food if required. The ewes drop their first lamb when two years old, and are kept on as long as they continue to breed well, some of them till they are nine or ten years old.

The earlier ram lambs are weaned early in June, the others after midsummer. The ewes and lambs are penned with "creeps," which admit the lambs to boxes containing mixtures of crushed linseed-cake, cotton-cake, and oats. After weaning the lambs go on to vetches till the clover "eddish"[1] has grown. Towards August the lambs get Enfield

[1] Aftermath.

Market cabbages spread to them, and afterwards they are penned, first on ox cabbage, then on kohl-rabi, and at a later stage on swedes. None of the lambs in the Cropwell Butler flock are castrated. The best of them are sold for breeding purposes, many of them being exported to various countries. The "culls" are shorn in March or April when about 13 or 14 months old, and are sold at the Nottingham fat stock market. In April 1907 a clipped hogget from this flock brought 61s. for slaughter, while its fleece of 20 lb. realised 1s. per lb.—in all, £4, 1s. for a hogget under 14 months old.

The female hoggets are grazed on pastures without extra food during the summer. The best of them are added to the home flock, and the others are sold for breeding purposes elsewhere.

Young rams are clipped in April. They are kept on "seeds" and "clovers," with swedes, mangels, Enfield Market cabbage, and vetches in succession, supplemented by concentrated food, such as cake and corn, as may be required.

Riby Grove Flock.

In Mr Henry Dudding's famous flock at Riby Grove, Stallingboro', Lincolnshire, lambs are dropped during February, March, and April, and are weaned in May or June. For some time before being weaned the lambs get a mixture of oats and cake and a few cut swedes. When taken from the ewes the lambs are put on to new "seeds," where cabbages and mangels are thrown out to them. As soon as turnips are ready the lambs are folded on them.

Ewes are kept on pasture till turnips are ready, when they are folded on the roots, getting cut straw and a mixture of cake, oats, and peas. After lambing the ewes go on to grass, where they get roots and the same dry food. Ewes are two years old when the first lambs are dropped, and they are cast when their teeth give way.

Young rams are treated similarly to lambs after weaning, the allowances of concentrated food being gradually increased. They get vetches in racks. Stock rams are kept on pastures till they go amongst the ewes.

Phenomenal prices have been obtained by Mr Dudding for the produce of his flock—up to 1450 guineas for a shearling ram, and 200 guineas for a ram lamb; shearling ewes, 15 to 30 guineas, and 10 to 15 guineas for ewe lambs. Ram lambs weigh about 25 lb. per quarter.

A portrait of a Lincoln ram is printed in Plate 51.

COTSWOLD SHEEP.

The Cotswold breed of sheep is to be found chiefly in Gloucestershire and the neighbourhood of the Cotswold hills.

Origin. — The early history of the breed ascribes the name Cotswold to "the range of oolite hills running from north-east to south-west, and occupying the eastern division of Gloucestershire." That point, however, is in dispute—the other suggested derivation of the name of the breed being "cotes," buildings, and "wold," the wild open country. The manufacture of cloth in the Cotswold neighbourhood by the Romans implies the presence of sheep, so that there is some ground for the assumption that the Cotswold is one of the oldest breeds of which we have record.

Improvement.

The improvement of the breed since the early times of last century has been very marked. From a large slab-sided, long-limbed, and heavily coated animal the modern well-ribbed, clean-cut type of sheep has been evolved. In the days of Bakewell, no doubt, the Leicester was used for grading up; and amongst the names conspicuous in the advancement of the breed in the early days are Garne, Hewer, Large, Lane, Barton, Gillett, Fletcher, and others. About the middle of last century, when agricultural shows began to play a strong part in live-stock breeding, the excellence of the breed attracted widespread attention. Ram sales were established, and the Cotswold was dispersed all over the British Isles — particularly to the southern and midland counties. They were certainly very adaptable sheep, and were capable of making themselves at home under every condition of soil and climate. In 1847 Mr R. Smith, in the course of a prize essay, mentions that

Cotswold rams were "much sought after for crossing with short-woolled breeds, and with good effect."

The breed has always been a tenant-farmer's sheep, and its earlier successes are therefore all the more creditable. The Oxford Down is perhaps the most pronounced example of the value of the Cotswold for cross-breeding. The old name of this type was Down-Cotswold, it having been directly descended from the Cotswold on the one hand and the Hampshire Down on the other.

About fifty or sixty years ago in Gloucestershire it was estimated that 5000 rams were sold and let in a season at a total revenue of £50,000. A good export trade prevailed to America, Australia, and the Continent.

Characteristics.

In appearance the modern Cotswold is a noble sheep. The head is a fine index of a sire. In the ram it should be masculine, wide between the eyes, the eye full and prominent but kindly. The nostrils should be well expanded and somewhat broader than the face, the colour of the nose being dark. The cheek should be full and covered with white hair, a slightly blue tinge on the cheek and round the eye being an attraction rather than otherwise. The ear should be fairly long, not too thick, and well covered with hair. They should be well carried, and a dark spot or two on the tips is not an objection. The forelock of wool should be plentiful and full from the top of the head, which should be free from coarseness. Grey faces are, of course, not fancied, although difficult to breed out entirely. In the ram the neck should be big and muscular, and should be long enough to enable the sheep to carry his head with gaiety. The neck should fit into the shoulders, which should lie well back. The point of the shoulder should have a good covering of flesh, which should be well spread over the chine. The ribs should be well sprung, the hips broad and well covered, the fleshing deep. The frame should be square, the legs set on straight and well outside the body. Long lustrous wool is looked for, the wool being regarded, as in all breeds, as an indication of the character of the flesh.

Mutton and Wool Production.—The Cotswold is a ready mutton and wool producer. It can be brought to market at from 9 to 12 months old, with ordinary feeding, at from 90 to 112 lb. dead-weight, and not infrequently the best flocks will turn out sheep from 120 to 130 lb. at that age. It is on record that a Mr Cother of Middle Aston killed a sheep aged 3 years and 9 months, weighing 336 lb. or 84 lb. per quarter, one of the legs of mutton weighing 54 lb. Good Smithfield live-weights for pens of three lambs, 9 months and 3 weeks old, are 5 cwt. 14 lb., and for three wethers, 20 months and 3 weeks old, 7 cwt. 3 qrs. 1 lb. Another good pen of three scaled 8 cwt. 2 qrs. 20 lb., at 21 months and 1½ weeks. The show of Cotswolds at Smithfield has fallen to very small dimensions, however.

In good flocks, from 9 to 11 lb. of washed wool will be clipped.

Prices.—The old prices and averages obtained at Cotswold ram sales are merely memories nowadays. There is a restricted home demand due to the advance of other breeds, although the foreigner takes a number, chiefly to North America, where there is a big trade for the Cotswold type of sheep. As a matter of history, it may be interesting to mention that in 1861 Mr R. Lane's average at his ram sale was £34, 10s. 8d.; in 1873 Mr R. Garne averaged £28, 16s. 4d. In 1864 Mr W. Lane of Broadfield bought one of Mr W. Hewer's rams for 230 guineas. Prices are very much lower to-day, the best figures being made privately.

MANAGEMENT OF COTSWOLDS.

The following plan of management is pursued by one of the largest, most prominent, and successful breeders. He mates his ewes in August so as to get as many lambs as possible in January and February, but the mating is continued so long as the lambs will be born by April. The ewes are put on grass or mixed seeds after mating, until the middle of November if the weather keeps open, and then on roots, which are fed sparingly, with a liberal allowance of hay. If the weather is very wet the flock ewes are run on pasture with hay

only. In January the first ewes are brought to the lambing-pen. They go on pasture during the day, and have roots carted to them. At nights, in the pen, they have as much hay as they can eat.

As fast as the lambs are born the twins are separated from the singles, the ewes with doubles being allowed a supply of Egyptian cotton-seed-cake and oats. The lambs are encouraged to eat oats and linseed-cake. The single lambs are treated in the way of feeding like the doubles, but the ewes are not given cake. The show lambs are selected when a fortnight old, and put by themselves with their dams. They receive oats, old split beans, linseed-cake, and a proprietary cake. The ewes are given a liberal allowance of cotton-cake and oats, with plenty of roots and the best hay. The lambs have pulped roots and hay. Pasture by day and the shed at night is the rule.

About the 1st of May the lambs with their dams are put on pasture, and the roots are carted to them. Weaning takes place about the middle of May, but the show lambs are not weaned till they go to the first exhibition, usually the Bath and West. All ewes and lambs are brought into the sheds at night, till the end of March or thereabouts. There are about two-fifths twins.

Ewes are only discarded when their breeding days are over. One ewe, for instance, was breeding until she was fourteen years old. Rarely are any marketed but old culled ewes. The yearling rams and ewes, and ram and ewe lambs, are sold principally for breeding purposes, a number going to Canada and the United States,—the remainder going for crossing purposes, only a few of the best being sold to home breeders.

When the lambs are weaned they go on young mixed seeds, sainfoin or vetches (tares), till roots are ready in autumn. About fifty of the best yearling ewes come into the flock every year.

The system of management described above is typical of the Cotswold ram-breeding flock. The principle upon which flockmasters go is to get lambs early, so that they will be well grown by the autumn, to feed them well, using the lamb-creep to enable the lambs to have the freshest bite. Culling is done in the summer, young sheep not up to the standard being dispensed with, and the good breeders kept as long as possible. Sainfoin is the popular legume for Cotswold sheep. The store lambs have turnips and hay in September, and come on to swedes about Christmas. The culls are sold fat to the butcher. Those fit to be kept for shearlings are retained. About two-thirds of the ewe-lamb crop are drafted into the flock.

A portrait of a Cotswold ram is represented in Plate 51.

THE DEVON LONG-WOOL.

The Devon Long-wool is one of four ovine tribes found within the confines of the county of Devon. It is a very ancient breed, although in point of character there is a great resemblance between three of the types common to Devonshire.

Early History.—The early history of the Devon Long-wool is somewhat obscure. It is maintained that it is descended from the old Bampton Nott sheep which were marketed in the town of Bampton in large numbers. *Bell's Gazeteer* in 1836 refers to these sheep as "of large size and an uncommonly fine quality from the excellence of the pastures." A little later Professor Wilson, writing of the Bampton Nott, remarked that "it is very difficult to find a pure Bampton unmixed with other blood, a few only remaining in Devonshire and West Somerset."

There is no doubt that in the time of Bakewell and since, Dishley Leicester blood was used to improve the fleeces of Devon Long-wools, and there is equally little doubt that Lincoln blood was likewise introduced. The South Hams rams from Totnes district were also used, so that flockmasters freely borrowed from the best sources in evolving the modern type of sheep.

Characteristics.

It is apparent that at the present day the Devon Long-wool has much in common with other Long-wool breeds of the Lincoln and Leicester type. It is a big framed sheep, with a plenitude of bone and substance. It is rather bolder

in the face than the Leicester, being larger in the head. It is wide at the base of the skull, and the nostrils in the ram are full and well developed. The ears are a good length, and a good tuft of wool should grow on the forehead. In appearance the Devon Long-wool is a bulky sheep, with a broad back, good loin, and strong dock. The leg of mutton is sometimes deficient. The skin is a nice pink. The coat should be uniform, the fleece being one of the important recommendations.

It may often happen that Long-wool sheep show great variety in the class of wool in a flock, and any tendency in the individual sheep to have coarse breech wool should at once be noted and that ram discarded for breeding purposes. When the writer inspected several of the leading Devon Long-wool flocks about the time the Flock Book was established, he was most struck by the lack of uniformity in the fleeces. That defect, however, is rapidly improving under the critical eye of the showyard judge and the flockmaster. The coat is often curly, in which respect it more resembles the Leicester than the Lincoln.

The flesh of the breed is of excellent quality, and should touch well under hand. Breeders have very carefully and successfully bred for "form," and the fact that so much success in the production of the fat lamb is attained in Devon, Somerset, and Cornwall from this breed, is independent testimony to the high character of its flesh.

Clip and Weights.—The breed clips and weighs well. The clip of a shearling ram would be from 18 to 24 lb., and perhaps exceed that figure. The ewes will produce to 12 or 13 lb. of wool, but 8 or 9 lb. is the average, and the lambs when shorn about 3 lb. and over. The breed is largely used for crossing with the Dorset Horn, the Dartmoor, and the Exmoor. It develops rapidly. In from 10 to 12 weeks fat lamb will dress to 10 lb. a quarter. The wethers are mostly sold as yearlings, dressing from 22 to 24 lb. a quarter.

MANAGEMENT OF DEVON LONG-WOOLS.

Rams are usually put with the ewes about the middle of September. When the tups are sound on their feet and vigorous, about fifty ewes may be allotted to each of them. In Mr E. R. Berry Torr's flock at Instow, North Devon, it is the custom after the rams have started work to take them in each morning and give them a few white peas and oats. The ewes are run on the best pastures, and a little cake and corn are given to them during the critical time. In Mr Berry Torr's flock rather over 50 per cent of twins are thrown by this treatment. The lambs come from the end of January to the middle of February. In the above-mentioned flock roots are avoided as far as possible for the ewes, the grass run being assisted by hay and straw chaffed and a few pulped roots. Just before lambing a little crushed oats or dried grains are given with the chaff and pulp.

The lambs from the best ewes are selected for rams, and the ewe lambs retained to keep up the flock. Of the remainder the fattest are sold when they reach about 9 or 10 lb. per quarter. Those not getting fat Mr Torr keeps on for turnips and sells them with others bought in about Christmas, when they scale from 18 to 20 lb. per quarter.

As soon as the lambs are born the ewes are dotted about in small lots on old pasture, and given a few roots with cake and corn; and when the lambs begin to pick up they are put on seeds, with the usual lamb creep, the youngsters having access to linseed-cake and lamb food, or home-grown oats and a few crushed beans or peas. For later comsumption cabbage, rape, and kale are grown, and the flock maintained in a thoroughly healthy condition.

A portrait of a Devon Long-wool ram appears in Plate 58.

THE SOUTH DEVON.

The South Devon sheep is bred chiefly in South and Mid Devon. In Cornwall it may be termed the leading ovine breed kept by farmers. There is a great similarity amongst the long-wool breeds of the south-west if we except the sheep that roam on the moors.

Origin.—The origin of the South Devon is difficult to discover, but there

can be no doubt that the modern type of sheep has been produced by the aid of Leicester and other Long-wools. They are supposed to have originated in the vale of Honiton, and descended from the South Hams Nott sheep, whose origin is wrapped in obscurity.

Characteristics.

In the early days they were described as having been inferior and badly shaped sheep, with heavy and coarse fleeces, but like most of the stock in the south-west of England, coming to great weight. They had brown faces and legs, which seemed to suggest a Devon affinity. The characteristics, however, were very materially altered by union with the Leicester.

Description. — The South Devon should carry a well-balanced head, broad, and rather long, and well covered on the upper portion with wool. The nostrils should be open and of a dark colour. The muzzle should be broad. The ears should be fairly long and of medium thickness, covered with hair, and are often spotted. The neck is strong and of medium length. A straight and level back from the withers to the setting on of the tail gives a symmetrical turn to the sheep. The shoulders should be flat and well covered, and ribs well sprung. The loins should be broad and the bosom deep. The sheep should stand squarely, with the legs well on the outside. The tail should be thick and fill the hand, the hind quarters being well filled and square. The skin should be pink and mellow. The fleece should be thick and even, of great length of staple, curly, and free from kemp or hair.

The South Devon is a sheep of nice symmetry, well grown, with plenty of bone and muscle. It thrives well on poor land, and responds very rapidly to generous treatment. Like most of the lustre long-wools it can grow fat when desired, but its strength of bone ensures that there is a good percentage of lean meat.

Weight and Clip.—It is on record that a seven months' old lamb of the breed weighed 224 lb., which is exceptional for any breed. The fleece on the average would weigh about 9 lb.

MANAGEMENT OF SOUTH DEVON SHEEP.

In the present day the South Devon sheep has attained a wonderful degree of perfection in symmetry and the weight of mutton carried. The efforts of the flockmaster in management are therefore to a considerable extent concentrated on the improvement of the fleece. The importance of the fleece can be realised when, even with wool on the down grade, the better class of flocks were able to realise from ½d. to 1d. per lb. more on their clips than was paid for ordinary wool in the district. In Messrs Tippett & Sons' flock at The Barton, North Petherwin, Egloskerry, the ewes average about 14 lb. of wool, whilst the rams clip from 26 to 33 lb. unwashed wool.

In the winter months hay, chaff, and roots are given on the grass, most of the flocks being kept in a natural state. Fattening is generally accomplished on roots and rape with artificial food. Fat lamb is one of the objects for which the breed is kept, and they attain good weights by Christmas. The ewes are very good mothers.

Mating takes place in September and October, but in the earlier flocks they put the rams to the ewes in August. Lambs arrive as early as the first few days in January, but February and March are the usual lambing months.

When the lambs are eight weeks old they can command from 40s. to 42s., making about 10d. to 1s. per lb. When sold by weight at a little over three months old, lambs scale about 68 lb., and later in the season they weigh up to 81 lb. They make the highest prices, as they carry a lot of flesh.

Ewes are drafted after the fourth lambing, but in the Barton flock favourites have been kept until ten years old.

A South Devon ram is represented in Plate 58.

WENSLEYDALE SHEEP.

The Wensleydale sheep is a product of Yorkshire. It is descended from an old breed called Mugs which were introduced into Wensleydale about the middle of the eighteenth century, and which were apparently a variety of the old Tees-

water sheep. The Wensleydale doubtless resulted from a cross of the Leicester on this breed, and has taken on a distinctive character.

The dark countenance of the breed is in a good measure due to the use of a celebrated ram called "Blue Cap," whose sire was a Leicester ram. This sheep was shown at the Royal Agricultural Society's Show at Liverpool in the year 1841.

At a later period the Lincoln ram was used, but the success of this cross is doubted by breeders, who had the ram trade, rather than the grazier, in view.

Characteristics.

Appearance.—The Wensleydale ram is strong boned, with great length of side, and a big proportion of lean flesh. A scale of points has been drawn up by the Wensleydale Long-wool Sheep Breeders' Society, as follows:—

	Points.
Head.—Face dark; ears dark and well set on; head broad and flat between the ears; muzzle strong in rams; a tuft of wool on the forehead; eyes bright and full; head gaily carried	20
Neck.—Moderate length, strong, and well set on shoulders	10
Shoulder.—Broad and oblique	5
Chest.—Wide and deep	10
Wool.—Bright lustre, curled all over body, all alike in staple	10
Back and Loins.—Ribs well sprung and deep; loin broad and covered with meat; tail broad; flank full	20
Legs and Feet.—Straight, and a little fine wool below the hock; fore legs well set apart; hind legs well filled with mutton	20
Skin.—Blue, soft, and fine	5
	100

For Crossing. — The Wensleydale sheep depends to a large extent for its prosperity upon the demand for rams for crossing purposes. As far back as 1847 the tup breeders of the Dale presented Mr Macqueen of Crofts, in the south of Scotland, with a silver snuff-box "as a token of esteem for his encouragement of the breed." The rams are chiefly used on the Scotch Blackface ewe, on which they have been particularly successful, producing what is known in Yorkshire as the Masham sheep. One of the reasons of their success is that the Wensleydale mutton, unlike the mutton of many other long-wool breeds, is hard and firm to the hand. As a hill sheep, too, it is active, and the Wensleydale ram never fails to keep up with its quarry, be it a mountain ewe or one of the larger breeds.

Interesting Crosses. — In certain trials carried out at Newton Rigg in Cumberland, the Wensleydale ram cross on the Border half-bred ewe (Cheviot Border Leicester) came out very satisfactorily. The experiments of 1904-5 enabled the verdict to be passed on this cross that it produced the fastest growing lambs, although less capable of fattening as they grew: "It would appear that these lambs fatten easiest when near mature growth. The lambs were not allowed to arrive until the herbage came, and they were not weaned till four months old. They are run at grass and fattened on turnips in the early part of the year, being killed and sent to the London market.

Clip and Weight.—A good Wensleydale flock of ewes will clip from 9 to 10 lb. of wool. The rams will produce from 14 to 21 lb. A celebrated ram, "Royal Darlington," clipped 20 lb. The breed is kept at an altitude of from 700 to 1400 feet above sea-level, and such weights as 30-stone rams are not unknown, although the general run of shearlings is from 18 to 25 imperial stones.

MANAGEMENT.

In the management of a Wensleydale flock well defined lines are followed. In the choice of a sire most breeders have a leaning towards a twin ram,—some, indeed, will not use a single in the belief that precocity and prolificacy can thus be bred into the flock. The ewes are excellent nurses, and it is therefore not surprising that as many as two lambs to the ewe should occasionally be a flock average. The ewes themselves are capable of rearing, and do sometimes rear, as many as three lambs in a season.

Previous to turning the ewes to the ram a gentle system of flushing by change of pasture is adopted. Not only do the sheep take the ram earlier in con-

sequence, but a better crop of lambs is believed to result.

The ewes, owing to the lateness of the district, are not put to the rams until October. Early lambing has no ascribable advantages. On the contrary, to face even a month of short-keep with a big crop of lambs does not appeal to the average flockmaster on the uplands of the north of England.

Little hand-feeding is done in a mild and open winter, but when necessity compels, as the severity of the weather frequently does, the simplest extra fare suffices. A little oats and hay will easily pull the flock through. At lambing, oats or cake are provided with dry fodder in the form of hay. When the turnips last they are also given, but not every farmer has a large enough breadth of arable land to grow them in sufficient quantities.

Shelter is provided for the new-born lambs, which are drafted out into the fields as the accommodation becomes limited.

A portrait of a Wensleydale ram appears in Plate 61.

KENT OR ROMNEY MARSH SHEEP.

The Kent or Romney Marsh sheep belongs to a race that is not of yesterday's creation. It is peculiar to the Romney Marsh district, where it thrives as no other breed could.

Sir Charles Whitehead has declared through the *Journal of the Royal Agricultural Society* that some one had suggested "that the aboriginal Kent sheep posed as the model of the cube upon four legs representing sheep in toy Noah's arks, and as toy manufacturing has long been carried on in the low countries, perhaps the breed, like hops and other good things, was fetched from Flanders."

There is a certain similarity between the sheep of the Netherlands and this breed. Mr Arthur Finn has recorded, in a lecture delivered before the Rye Farmers' Club, the formation of a town flock at Lydd as long ago as 1572. This flock was founded in return for certain people giving up rights of common land.

No doubt, about Bakewell's time, the Improved Leicesters were extensively used in the Marsh, and the type of sheep grazing there was materially changed in consequence.

Characteristics.

The breed has a very hardy constitution. This can be readily understood from the nature of the land on which it thrives without the assistance of artificial food. In their native county reclaimed pastures are not uncommonly found side by side with the poorest and barest lands sparsely covered with vegetation. On the one the breed rapidly fattens, and on the other it can find sustenance.

Points.—The chief points of the breed may be considered as follows: The head should be wide; the ears should be thick; there should be no dark hair on the poll, on which a covering of wool is looked for. The head is white and the nose black. In form the typical Kent sheep is very thick, and shows great width of chest. It stands on very short legs, with thighs, loin, and rump well developed. The fleece should be of one kind, without coarse breech wool, the staple being good and thick on the pelt. The breed is essentially a mutton one, the favourite cross being the Hampshire or Southdown.

A good crop of lambs would be 1⅓ per ewe, although Mr Arthur Finn, in his flock at Westbroke, Lydd, records a fall of 519 lambs from 300 ewes on one grazing occupation.

Clip.—The clip of good ewes would be from 8 to 10 lb., the former figure being about the average. A good flock, in which the ram lambs are shorn, would average from 6½ to 7 lb. per fleece. These weights are for washed wool, in some flocks washing being performed twice.

The Kent sheep is wonderfully immune from foot-rot, and is inured to the fluke trouble which visits most marshy lands.

A foreign trade of considerable dimensions has sprung up since the Flock Book was established.

Weights.—An average weight for fat wethers fed on grass would be from 10 to 11 stone. Taking the Smithfield Show weights, 10½ oz. daily is a very high gain for lambs, the average being

9.8 oz. per day. The wethers average 6.9 oz. daily increase.

MANAGEMENT.

Breeders of Kent or Romney Marsh sheep are to some extent divided in opinion as to the type of ram to use. Some of them endeavour to grade the flock to a level, and thereby obviate the necessity of using a strong or coarse tup to correct the fault of too much quality. Mr J. B. Palmer of New Shelve Manor, Lenham, does not believe in having coarse or fine rams to mate with ewes of opposite character, but to fix the type and draft all ewes that do not conform to it. His plan is to flush the ewes for about a week before admitting the rams, as by so doing he considers that he gets a greater crop of lambs. When the rams are taken from the ewes he keeps the latter in fair condition. It is important, however, that they should be in good condition when they drop their lambs. Last year his ewes had quite 50 per cent of twins.

The general management of a flock on the Marsh is not an elaborate matter, as sheep can live there without extra food except in very severe weather. Early maturity is not a strong point with Kent sheep-breeders. In some of the flocks the policy carried out is to mate the old rams with the young ewes, and the yearling rams with the ewes of more mature age. The matrons showing symptoms of a weak constitution are drafted out after weaning. The limit age in the ordinary flock is four years. At times the best of the old ewes are retained for a special reason, and are kept perhaps a year longer. It is not advisable, however, to keep ewes too long in the flock, for grazing on good pastures and coarse grass makes long and therefore loose teeth. When that happens the ewes are likely to come to weaning-time in very poor condition.

Mr F. Baker of Manor Farm, Frindsbury, Rochester, does not think that the crop of lambs is so large as formerly. "This," he says (1908), "I attribute to the fashion of putting up the yearling ewes to such a useless extent. Some thirty years since the increase of 25 to 30 per cent of lambs to ewes tupped was not unusual, but now it only amounts to 5 or 10 per cent, and in the starvation years of the 'Nineties one lamb to each ewe was scarcely weaned."

The fleeces are becoming more uniform and better in quality, from 7 to 7½ lb. being a good flock clip.

Mr Baker estimates that the average weight which the ewe flock attains is 9 stone in the first year, 10 stone in the second, and 11 stone of 8 lb. in the third.

A ram of the Kent or Romney Marsh breed is represented in Plate 62.

ROSCOMMON SHEEP.

Of several native varieties of sheep which at one time existed in Ireland the only breed now surviving is the Roscommon Long-wool. The breed is believed to have been reared in the province of Connaught for centuries, though it is doubtful if it was distinguished for either good looks or high merits till wellnigh the middle of the nineteenth century.

It appears that strains of the race kept on the higher and poorer lands were of an inferior character, but that the bulk of the breed kept on the lower and richer parts were big useful sheep, though lacking in symmetry.

Improvement of the Breed.—In due time the improvement of the breed was taken in hand by the more enterprising of its supporters, and partly by the moderate infusion of the blood of English long-woolled breeds, notably of the Leicester, and partly by skilful selection within the breed itself, a marked change for the better was introduced. To a large extent this improvement was effected during the third quarter of the nineteenth century; but since then, by careful selection and liberal and judicious treatment generally, much has been done not only to enhance the appearance of the sheep, but also to raise to a higher level their characteristics from a rent-paying point of view.

Characteristics.

The Roscommon sheep of the present day where well kept are large-sized, handsome sheep, hardy in constitution, and excellent grazers. They do not

mature quite so rapidly as some of the other long-woolled breeds, the explanation of this being the fact that Roscommon sheep have from time immemorial had to pick up their living from pasture-lands, and have only in quite exceptional cases had the forcing feeding applied to most other breeds. With moderate time to mature, Roscommon sheep attain heavy weights. Rams three to four years old have yielded from 300 to 380 lb. of carcase. Mr Matthew Flanagan, Tomona, Tulsk, Co. Roscommon, usually sells his wedder hoggets for killing in November and December, when about eighteen months old, their carcase weights running from 27 to 32 lb. per quarter. The price obtained is always the highest rate in the markets at the time. Indeed, the Roscommon mutton is superior in quality to that of most of the other long-woolled breeds.

The Roscommon is a hornless breed, carrying a long, lustrous fleece; the head is well shaped and well posed; face long and white, sometimes with and sometimes without a tuft of wool on the forehead; the ears fine, white, and of medium length, with perhaps a pinky tinge; the muzzle strong in the ram; the tail well hung and broad; and the legs strong.

Fleece.—The Roscommon wool has a good reputation amongst wool-buyers. The fleece is very white and bright in colour, and lustrous. From sheep kept entirely on pastures the fleece weighs from 8 to 11 lb., and from sheep that are partly hand-fed and generally well cared for the weights will rise to from 12 to 16 lb.

MANAGEMENT.

The management of Roscommon flocks is usually simple in the extreme. As already indicated, the sheep are, in the main, left to forage for themselves both in winter and summer. It is only in a few flocks where ram-breeding or feeding for early maturity is pursued that any hand-feeding is resorted to.

March and April are the lambing months, and the lambs are weaned about the second week in June.

Mr Flanagan, already mentioned, gives his ewes about 1 lb. each per day of a mixture of cake and oats for a short time before lambing, and for a similar time after lambing about 2 lb. daily of linseed-cake and crushed oats. Throughout the rest of the year there is no hand-feeding. Mr Flanagan sells a number of young rams for breeding purposes, getting from £7 to £12 each when they are about eighteen months old. The ram lambs are taught to eat cake along with their mothers in spring, and they get a small allowance of this food up till the selling time.

The portrait of a Roscommon ram is given in Plate 64.

HALF-BRED SHEEP.

This is the name usually given in Scotland and the northern districts of England to the first cross between the Border Leicester ram and the Cheviot ewe, and the produce of these crosses when mated together. Strictly speaking, the Half-bred is not a breed at all, but a variety or type. Yet the name has, through use and wont, come to be specially identified with this particular cross, and nowadays Half-breds are looked upon almost in the light of a breed. Half-bred sheep have had separate classes at the shows of the Highland and Agricultural Society, and at other leading shows in Scotland, for many years, and although they have no flock book or breed society, they are as carefully bred, and have as clearly marked characteristics, as most of our registered breeds.

Founding of the Breed.

Northumberland is entitled to the credit of having been the county where Border Leicester rams were first systematically put to Cheviot ewes, the pioneers of the cross being generally believed to have been Mr John Borthwick of West Newton, his son Mr Charles Borthwick, also of West Newton and Mindrum, and the late Mr Elliot of Lamberton. Each of these gentlemen is known to have bred Half-breds from a Border Leicester ram and a Cheviot ewe many years ago. Mr John Borthwick, indeed, had a regular flock of Half-breds early in, if not before, the opening of the Victorian era. At that time it was customary to breed Half-breds through the medium only of

the first cross. But as the merit and great value of the sheep for general purposes became more widely known and appreciated, and as they began to spread over the Border districts, breeders took to mating half-bred to half-bred, in the first instance at any rate, as a means of getting up numbers quickly and cheaply. Good Border Leicester rams in these days were not so numerous as they are now, and the half-bred to half-bred system enabled their influence to be carried further in a short period of time.

The practice of putting half-bred to half-bred is still pursued to a considerable extent, and there is a good deal of difference of opinion among the followers of the two systems as to which is the better. Those who give attention to showing and tup-breeding adhere almost exclusively to the first cross. They maintain that a sharper-headed and finer-boned animal can be got in this way than through the second generation of the cross. They also hold that the white hair on the face is purer, as a rule, in the case of a first cross than in the produce of subsequent crosses, the wool being also usually closer and denser on the body. On the other hand, the females of the second and subsequent crosses usually grow to bigger sizes than first crosses of the same class, while they feed fully as quickly.

Two Classes of Half-breds.

Writing some years ago on the difference between the two classes of Half-breds, Mr Andrew Elliot, Newhall, Galashiels, who has been a prominent breeder of half-breds for many years, said—

"In some minds there is a prejudice against the half-bred and half-bred breed, but in every instance where the rams are selected with judgment and care, they can be bred in this way for any length of time without deteriorating in size, style, or value. In this part of the country we have many instances of flocks that have been bred in this way for the last twenty-five years, and have not only been successful but are growing daily more in favour. Although it is usual to have the rams of the first cross, I am quite convinced that it is perfectly practicable to breed them pure half-bred and have even better sheep if done with the skill of a judge. There might be a prejudice against them for a time, but I feel confident that the result would be a success. As show animals the ewes got by half-bred rams will always beat those of the first cross (that is to say, if they be bred with care and skill), as they show so much greater weight, which is always an advantage if you have quality along with it."

Practically the same views are held to the present day, and it is not very wide of the mark to say that nearly one-half of the Half-breds, in Northumberland in particular, are of the half-bred to half-bred cross. Although the one class—unless for special purposes—sells as readily as the other, it is usual at sales, especially in the case of breeding gimmers, to intimate whether they are of the first or the second cross.

Distribution of Breed.

For a good many years Half-breds were confined to Northumberland and the arable districts of the south of Scotland adjoining the Border. But in course of time they spread widely over the country, and large numbers are now bred as far north as the counties of Sutherland and Caithness. Indeed, Sutherland and Caithness Half-breds, like Cheviots from the same localities, have a special place in the market, and are very popular in the feeding districts of the Lothians and elsewhere. Although many fairly high-lying farms in Berwickshire, and a good part of the lower slopes of the Lammermoors, are under Half-breds, the breed does not attain its best results on very high grounds. Half-breds are essentially a low-ground sheep; they require plenty of food of a good quality, and do best in association with turnip husbandry. Properly managed, no sheep have paid better in recent years than Half-breds.

Early Lambs from Half-bred Ewes.

Half-bred ewes are very prolific, producing usually on the average from one and a half to two lambs apiece per season. They are also good mothers, milking excellently as a rule. In addition to their value for ordinary Half-bred breeding, Half-bred ewes have a special

value for crossing with other breeds. Thus, in late years they have been extensively crossed with Oxford and Suffolk rams for the production of fat lambs. Lambs of these two crosses grow to big sizes very early; indeed, lambs from Half-bred ewes and Down rams now constitute fully one-half of the early lambs bred in Scotland.

Three-parts-bred Lambs.—Half-bred ewes are also to a large extent used for the production of what are called three-parts-breds—that is, sheep having three parts of Border Leicester blood to one of Cheviot, the Border Leicester being again the ram used. This was a very popular animal in East Lothian and one or two other districts before the Down crosses became so popular, and it is still bred by many in preference to all others, especially where the animals are intended to be fed off as lambs or in the hogget stage.

Increasing Popularity.

Since crossing with Down rams for fat lambs became general, Half-breds have increased still further in popular favour, and may now be said to be used in one or other of their forms from one end of Scotland to the other. They have also greatly increased in numbers in Northumberland, where, owing to their suitability for being fattened on turnips, they are now the prevailing low-ground sheep.

Characteristics.

Appearance.—From the way it is bred it is hardly necessary to say that the Half-bred is a white-faced breed. It is also hornless. The head of a well-bred sheep should be well covered with pure white hair. The ears should be erect and mobile, with a slight inclination forward, and also well covered with white hair. The eye should be bold, bright, and prominent; the forehead should be wide and open; and the muzzle black, like a Border Leicester, and fairly wide, with good open nostrils. The neck should be strong and well set on the shoulder; the chest should be wide, and the ribs well arched. It is a strong point in favour of a sheep to be thick through the heart. Indeed, with many judges sheep that are not thick through the heart stand little chance of getting notice in the show-ring.

The back should be straight and well carried out to the rump, with quarters wide and deep. The wool should incline more to the Cheviot than the Border-Leicester in closeness, and should be very fine in staple and uniform all over the body. Finally, the animal should be well set on fine flat-boned legs, should carry its head well, and be a good walker. The last is a point of great importance, and is never overlooked by a careful capable judge.

Weights and Feeding Qualities.—From a commercial point of view there is nothing to excel a good class of Half-breds. They grow to big sizes, come early to maturity, and, whether as hoggets or hoggs, make excellent butchers' sheep. The weights to which Half-breds can be brought may be judged from the facts that at the Scottish National Fat Stock Show in Edinburgh in 1907, a pen of three wedders of the breed under two years old scaled alive 865 lb.—an average of 288 lb., and a pen of three ewes 708 lb., an average of 236 lb. Cheviots on the same occasion scaled an average of 244 lb. for wedders and 217 lb. for ewes—these weights, however, being rather exceptional for Cheviots.

Clip.—Half-breds are also very good wool-producing sheep. A ewe flock should clip from 5¾ to 6 lb. of wool per sheep, and where hoggs are included a little more. Half-bred wool realises practically as much as Cheviot wool when the sheep have been well fed and are of a good class.

Sale Centres.

The great sale centre of half-bred ewes, gimmers, and lambs is St Boswells, although finely bred half-breds can now also be bought at Rothbury, Perth, Inverness, and other centres in Scotland and the north of England. Rams in the same way are mainly sold at Kelso, although sales are also held at Lockerbie, Edinburgh, and other places.

Being purely commercial sheep, half-breds have not the aristocratic support which is frequently extended to other breeds. Both rams and females, however, sell very well, and occasionally

realise comparatively high prices. A half-bred ewe stock will usually realise from 40s. to 75s. per head according to age, while rams make anything up to £40, specially choice ones occasionally going as high as £50. In 1906 ten specially fine Half-bred rams from Mr Jeffrey's flock at Deuchrie, Prestonkirk, averaged as much as £19, 13s. per head. The highest price in 1907 was £40, again for a Deuchrie ram.

MANAGEMENT OF HALF-BRED FLOCKS.

The general management of Half-bred flocks does not differ materially from that of Border Leicesters. Both are essentially low-ground sheep, and if they are to give the best results they must be liberally treated. No one, for example, who has not a fair supply of young grass in the spring need hope to breed Half-breds very successfully. Ewes of the breed rarely average under 1½ lambs per head. A good supply of milk in the spring is therefore a first necessity, and in no way can it be got or kept on ewes more easily than through a good supply of succulent young grass.

With either Border Leicesters or Half-breds it is also very desirable to have at call a fair quantity of turnips. Nothing makes better winter food, and supplemented with a little cake, corn, or hay, the roots will bring the ewes on to lambing in first-rate form, and carry them on to the grass. With Half-bred ewes, particularly when they are crossed with rams of the Down breeds, lambing begins earlier than it does in the case of Border Leicesters. Many aim at having the lambs arriving as soon after the New Year as possible. In such cases it is possible to have the lambs ready for the market by the end of April or the 1st of May. Lambs bred in this way usually fetch from 35s. to 44s. per head.

On regular Half-bred farms, where breeding for the ordinary breeding and feeding market is the object aimed at, lambs arrive from March onwards. Such lambs are usually drawn and sold during the month of August. Ewe lambs suitable for breeding purposes will then realise quite readily 40s. per head, and occasionally a little more. Wedder lambs usually realise slightly lower figures, and are bought either for feeding off on turnips during the ensuing winter, or for keeping on to the shearling stage.

Cast ewes are usually drafted out after they have nursed their fourth crop of lambs. Ewes of this age are sold towards the end of September or early in October, and are largely bought for putting to a Down ram, the ewe and the lamb going away together, fat, as early as possible in the ensuing spring. Rams are sold in September, and go amongst the ewes early in the following month. In special cases where exceptionally early lambs are wanted the rams are turned out earlier.

Half-bred ewes do not, as a rule, give much trouble at lambing time, being hardier than Border Leicesters. All the same, they require close attention on the part of the shepherd at this time if the best results are to be obtained. Lambing, as in the case of the Border Leicester and other low-ground sheep, takes place, as a rule, in specially prepared pens, near the steading, the ewes being kept in adjoining paddocks for some days both before and after they lamb.

With many of the outlying parts of farms being laid down to grass, Half-breds have the prospect of having an even extended sphere of usefulness.

A portrait of a Half-bred ram is given in Plate 56.

SHORT-WOOL AND DOWN BREEDS OF SHEEP.

THE SOUTHDOWN SHEEP.

The *doyen* of the short-wool breeds of sheep is undoubtedly the Southdown. It holds amongst these the same estimable position that the Leicester does amongst long-wools. It is native to the range of hills which runs through Sussex. There can be no doubt that it has been largely used in the building up of other breeds, such as the Shropshire, Oxford Down, and Suffolk.

Early Improvers.

In the early times of Arthur Young speckle faces were common, but to-day the demand runs on a nice mouse-brown colour. Ellman of Glynde was one of the earliest improvers of the breed. He brought his flock to a high pitch of excellence. We know little or nothing of his methods, but it has been suggested that he may have introduced a dash of Leicester blood.

Arthur Young states that the "Ellman flock of sheep is unquestionably the first in the country. . . . He has raised the merit of the breed by his unremitting attention, and it now stands unrivalled."

According to Youatt, the Ellman type of sheep, as exemplified in the head, was as follows: "The head small and hornless; the face speckled or grey, and neither too long nor too short; the lips thin, and the space between the nose and the ears narrow; the under jaw or chops fine and thin; the ears tolerably wide and well covered with wool, and the forehead also; and the whole space between the ears well protected by it as a defence against the fly; the eye full and bright but not prominent."

When Ellman sold out, in 1829, his ewe flock of 770 head averaged £13, 1s. 6d.; 320 lambs averaged 36s.; 32 ram lambs 110s.; 360 rams of mixed ages 125s.; and 241 wethers 21s. These were big prices in those days. Francis Duke of Bedford gave Ellman 300 guineas for the hire of a tup for the two seasons of 1802 and 1803.

Subsequent improvement was brought about by Jonas Webb of Babraham, whose ram-lettings were famous.

Characteristics.

The characteristics of the Southdown are first flesh, second wool. The breed is recognised as the finest mutton-producer, the great aim being to make it the sheep of the epicure. The Southdown Sheep Society, an amalgamation of two pre-existing societies, has approved the following descriptive scale of points:—

Description and Scale of Points.

	Points.
Characters.—General character and appearance	10
Head.—Wide, level between the ears, with no sign of slug or dark poll	8
Face.—Full, not too long from the eyes to nose, and of one even mouse colour, not approaching black or speckled; under jaw light	4
Eyes.—Large, bright, and prominent	2
Ears.—Of medium size, and covered with short wool	2
Neck.—Wide at the base, strong, and well set on to the shoulders; throat clean	5
Shoulders.—Well set, the top level with the back	7
Chest.—Wide and deep	5
Back.—Level, with a wide flat loin	10
Ribs.—Well sprung, and well ribbed up, thick through the heart, with fore and hind flanks fully developed	7
Rump.—Wide and long, and well turned	4
Tail.—Large, and set on almost level with the chine	4
Legs of Mutton.—Including thighs, which should be full, well let down, with a deep wide twist	10
Wool.—Of fine texture, great density, and of sufficient length of staple, covering the whole of the body down to the hocks and knees and right up to the cheeks, with a full foretop, but not round the eyes or across the bridge of the nose	10
Skin.—Of a delicate bright pink	5
Carriage.—Corky, legs short, straight, and of one even mouse colour, and set on outside the body	7
	100

Disqualifications.

Judges at Breeding Stock Shows are advised not to award a prize to otherwise good sheep on which are to be seen—(*a*) horns, or evidence of their presence; (*b*) dark poll; (*c*) blue skin; (*d*) speckled face, ears, and legs; or (*e*) bad wool.

Types.—It would perhaps be erroneous to say that there are two types of Southdown—one the original small, compact hill type, and the other a larger and weightier sheep. The fact is that, when the Southdown is taken on to very good mutton-producing land, it has a tendency to reach greater weight, which can be counteracted only by the use of small sires. Grey faces and muzzles are frequently met with, some of the best types otherwise having that lightness of countenance which breeders profess to avoid.

Mr Ellis of Summersbury, Shalford, had a famous flock which won many honours in the showyard. On the question of type in the Southdown sheep he declared his opinion as follows: "When I first began breeding (and looking at the judgments passed, especially at the fat stock shows), it may be said that Lord Walsingham's sheep were greatly in favour. They were large, well fleshed, but somewhat coarse. They were not of the type of the Ellman flock, nor had they the symmetry of the Duke of Richmond's or the Throgmorten sheep. At that time there was nothing like the disparity in price which now exists between the coarser and the finer carcases of mutton, and small joints were not so much in request. . . . I have always stuck to the finer type whatever the judgments of the year may have seemed to favour." Speaking of the different types he says: "Some may be delicate and too refined, with extremely small bone, but generally with good wool; others, again, high on the leg, with poor legs of mutton and narrow in the chest; while others, without being in any way coarse, are of the square, blocky, short-legged type. I think there is no doubt that soil and climate do affect and alter the type of sheep as of other animals. Without wishing to dogmatise on the matter, I think that Southdowns removed from the south of England, especially if on rich land, tend to increase in size, and at the same time lose some of the especial characteristics of the breed. I am bound, however, to say that there are exceptions. I have always aimed at a sheep very low on the legs and very square, with the legs well outside of it and width between the fore legs, giving plenty of room for the vital organs. I have never finished judging a sheep until I have turned him up. Then the wool should be short, close, and hard as a board. Such fleeces always weigh well, besides being splendid non-conductors of heat and cold."

Dead Weight.—A good shearling wether will kill about 20 lb. a-quarter, and lambs well done will reach about 15 lb. The smaller type of lamb kept in the hill district will probably dress a 50-lb. carcase if well fattened. It may be mentioned that the Southdown kills very light of offal, as much as 65 per cent of dead to live weight being common.

Weight and Value of Fleece.—The clip on the Downs is probably in the neighbourhood of 4 to 4½ lb. In the eastern counties, where there are many good flocks, from 5 to 6 lb. is shorn. The wool is exceptionally fine, and easily earns the top price in the market—next to Merino.

For Crossing.—The Southdown has been more used as a parent cross in the production of other breeds than for crossing purposes in ordinary commercial flocks. It is very popular abroad, particularly in the United States, France, and the Antipodes. By its use good carcases for freezing are produced. The Southdown has impressed experimenters more by the quality than by the quantity of its produce.

MANAGEMENT.

In the course of a lecture which he delivered in 1865 before the Royal Agricultural Society, Ellman mentioned that the one great point to bear in mind was that the Southdown should be made to graze pastures closely and thus prevent the growing up of coarse herbage. The supplementary forage crops he used included rape sown in the early part of hay and vetches, while sainfoin was considered particularly suitable for fat lambs. These views are practically those of the flock-masters to-day.

The management of a Southdown flock may be divided into two classes—hill flocks and those occupying the lower and more fertile lands. As a typical instance of the latter we may take the method pursued in Mr C. Adeane's noted

flock at Babraham, near Cambridge. The breeding ewes have the run of grass as their sole food from October till the end of November. Their night fold is on the arable land. In the early part of December a little clover or grass-hay is given every evening in addition to what they graze. Should the weather be very cold, the rations are further supplemented and varied by folding on a small portion of white turnips. The belief, however, prevails that when carrying their lambs it is better for the ewes to have as few roots as possible. About ten days prior to the time when the lambs are expected the ewes receive a little cake or other artificial food.

The lambs usually begin to arrive early in February, the breeding season extending over two months. After the lambs arrive the ewes are allowed as many turnips as they can consume on grass. If a grass field does not lie convenient to the temporary lambing-pen, the lambs when three or four days old go with the ewes to the fold on a turnip field.

Mr Webb, the agent at Babraham, is convinced that it is preferable before lambing to give long hay, a run at grass, with very few turnips, to feeding oat-straw chaff and a liberal allowance of roots.

A good crop of lambs to rear would be about 125 or 130 to each 100 ewes.

The ewes are culled in the autumn, the retention of the flock ewes being largely determined by a system of recording the pedigree and the produce. The peculiarities of ewes, some breeding females better than male lambs, and *vice versâ*, can by this means be accurately studied. Mr Webb also finds it a great help when deciding which lambs to save for rams.

About half the males are saved for rams, about one-third of these finding buyers as ram lambs. In the autumn the number of ram lambs is reduced to 70, the culls being killed for mutton.

The ewe lambs are wintered as stores, and about 80 of them are drafted into the flock when nearly sixteen months old, the remainder being disposed of as yearling ewes for breeding purposes.

On the hills the lambing date is later than on the lowlands, the end of March being a favourite time, although the tendency is towards an earlier period. Prior to lambing a little cake and hay are given. Running the newly lambed ewes on rape sown in August, and later on vetches, is a common practice. Successive sowings of rape are made, so that at weaning in July the lambs may pass on to an April-sown green crop. Other green foods popular in the south are sainfoin and a mixture of white clover, trefoil, and Italian rye-grass.

Drafting takes place before tupping, most of the flocks being in three ages. The usual practice is to use shearling and two-shear rams, but ram lambs are more frequently brought into service now than they at one time were.

A portrait of a Southdown ram is given in Plate 52.

THE SHROPSHIRE.

The Shropshire breed is common to the county from which it derives its name. In stature and weight it fills a place midway between the Southdown and the Hampshire.

Origin.—The origin of the breed is a much-disputed question. Some contend that it is the result of a cross on the Morfe Common sheep which led an untamed existence on that stretch of land near Bridgnorth. Others, again, believe it to be a cross on the original Longmynd or old Shropshire sheep. Yet a third party holds to the belief that its foundation was laid on a breed known as the Whittington Heath sheep. From conflicting views, it is difficult at this late period to arrive at an accurate judgment. Those who assert that it is a cross-bred mention the Leicester, the Cotswold, and the Southdown as probable crosses. Possibly a dash of the Merino was also infused.

Early Breeders.—Two of the earliest and foundation breeders were Mr Samuel Meire and Mr George Adney. In 1858 Meire stated at a farmers' meeting that it was not his intention to deny that the Shropshire was a cross-bred sheep, and that the Southdown had been used to get rid of horns.

Early Types.—When the Shropshire was first afforded separate classification at the Royal Show at Gloucester in

1853, the description then given of the breed mentioned faces and legs of grey or spotted colour. The head was well carried on a thick neck. The back was straight, the breast deep and broad, though the hind quarters were hardly as wide as the Southdown's. The dead-weight of the tegs would average from 80 to 100 lb. each. The fleece was described as more glossy and longer than that of other short-wools, the weight of it being about 7 lb.

Modern Types.—It is a far cry to 1853. Now the Shropshire is a beautifully formed sheep with a soft thick fleece, well covered head muffled to the nostrils. It stands on short legs, is very lengthy in frame, and kindly to the hand. The skin must be pink—a strong point in breeding—and there must be no suspicion of black hairs in the wool, or incipient horns at the poll.

There are two types of sheep—the breeders' and the farmers'. For convenience the latter are usually termed pasture-rangers. The farmer requires a larger, and what the pedigree breeder would probably call a coarser, type of sheep than would be used in the production of a Royal Show winner.

Merits of the Breed.

Mr Alfred Mansell of Shrewsbury thus epitomises the good points of the Shropshire sheep:—

Prolific Character.—150 to 175 lambs per 100 ewes is the usual crop. In 1896, 11,666 ewes reared 168 lambs per 100 ewes.

Shropshire ewes are excellent nurses. Nature has endowed them with great milk-yielding properties.

The Shropshire sheep cuts a heavy fleece of the most marketable description, being of good staple, fine in texture and dense, with small loss in scour.

The Shropshire sheep is ubiquitous, being found in the Highlands of Scotland, the humid climate of Ireland, the mountainous districts of Wales, and is frequently found at an altitude of 1000 feet over sea-level.

If well cared for, wethers are fit for the butcher at ten to twelve months old, and that on a moderate consumption of food. Shropshire lambs mature very early as fat lambs.

The breed is notoriously sound in constitution, and capable of withstanding extreme variations of heat and cold. A Shropshire ewe nineteen years old, still hale and hearty, had reared 33 lambs, and enjoyed immunity from foot-rot during the whole of that period.

The quality of the mutton is rich in flavour, contains a large proportion of lean flesh, and commands the highest price in the London, Manchester, Liverpool, and other markets of Great Britain.

The Shropshire is placid and contented, not given to roaming and trampling down pasture.

The Shropshire-Merino is preferred by many who have tried it to any other cross. The half-bred is a deep square sheep, well covered with a fine close fleece, which gives a high percentage of clean scoured wool. The sheep are hardy, and fatten to nice handy weights at a very early age.

Lambs from Clun ewes by a Shropshire ram have realised 49s. each at the Shrewsbury Easter market.

Progress of the Breed.—Some evidence of the progress of the breed may be obtained from the great displays it has made in leading showyards. In 1860, when the Royal Show was held at Canterbury, there were no fewer than 192 entries. All records, however, were beaten when the Shrewsbury Royal Show took place in 1884. No fewer than 875 Shropshires were exhibited by sixty breeders hailing from fifteen counties. The breed has continued to hold its own, having a remarkable export trade to the United States and the Antipodes.

Weights.—Shearling wethers kill from 22 to 24 lb. per quarter, and the clip will vary from 8 to 10 lb.

For Crossing.—The Shropshire is largely used in the Midlands for crossing with white-faced sheep. It is also extensively employed for crossing with different native breeds in Scotland and Wales. Its most signal triumphs, however, have been recorded abroad—in Australasia in particular.

MANAGEMENT OF SHROPSHIRE FLOCKS.

Shropshire sheep are capable of repaying liberal treatment, and they usually receive it. A niggardly system in respect

to food would be unwise with sheep that yield so well as the Shropshires do in both wool and mutton.

The methods of management pursued generally in Shropshire flocks in England are fairly well indicated by information which, in response to our request, Mr T. S. Minton, Montford, Shrewsbury, has been good enough to supply as to the system followed in his own flock.

Lambs.

The lambs are dropped in February and March. They are weaned near the end of June. For a time before weaning the lambs are allowed to run on clover ahead of the ewes, through hurdles that let lambs pass but hold back ewes, and there they receive 2 to 3 oz. each daily of a mixture of split-peas, linseed-cake, and bran. The "lamb-hurdles" are moved every three or four days. After weaning, the lambs go on to thousand-headed kale for two or three hours daily, and receive mangels on clover aftermath.

Young Rams.

Most of the ram lambs are kept for breeding purposes, and are sold when shearlings. The majority are bought by home breeders, but many of them are exported to the United States, Canada, South America, Russia, Japan, &c. The cast ram lambs are fattened and sold to the butcher, yielding from 76 to 80 lb. dead-weight when about twelve months old.

In the rearing of young rams a careful system is pursued to ensure steady growth and vigorous constitution. When thousand-headed kale and mangels are finished, which usually happens about the end of August, the young rams are hurdled on root-land and receive white turnips cut into finger-pieces: here they remain till Christmas, when they get cut swedes, at the same time receiving clover-hay *ad lib.* in racks. They also get ½ lb. per day of a mixture of corn and cake, this allowance being gradually increased till it reaches 1 lb. by the month of April.

The best of the rams, which may be intended for showing, are clipped in March, the others being clipped later. After being clipped they are housed at night for two or three weeks, but as soon as the weather permits they are turned on to "seeds," with plenty of roots, being housed in very wet weather.

Ewes.

A number of the best of the ewe lambs are every year added to the flock, and they drop their first lamb when they are two years old. Ewes that are specially good breeders are often retained in the flock till they are seven or eight years old. Before being put to the ram, ewes are "flushed" by feeding on reserved clover leas, and they remain on these leas till near lambing time. As soon as grass begins to fail, or frosty nights set in, the ewes receive a good feed of clover-hay in racks, care being taken to have plenty of racks to prevent crushing.

A week or two before lambing the forward ewes are drawn out in turn, and receive about 1 lb. per day of a mixture of bran, oats, and clover-chaff. After lambing the ewes receive a very few roots, either swedes or mangels, on grass-land. Ewes and lambs are not put on to "seeds" until the lambs have begun to graze.

Mr Alfred Mansell, who has done much to promote the interests of Shropshire breeding, dealt exhaustively with the management of breeding flocks in a paper read at the Ninth International Conference of Sheep-Breeders at Newcastle-on-Tyne in June 1908. Young breeders would do well to peruse that interesting paper.

Mr T. A. Buttar's Flock.

Mr T. A. Buttar, Corston, Coupar-Angus, Forfarshire, has at our desire furnished the following description of his methods of management:—

I keep a flock of about 260 pure-bred Shropshires, fully pedigreed and registered in the Shropshire Flock Book.

I find them a very hardy, thrifty breed; they can be run thickly on the ground, and they produce the best class of mutton and wool.

The flock was started in 1870 by my father, and the pedigree of each individual has been carefully kept.

System of Ear-marking.

Each ewe in the flock has a separate and distinct ear number, and her lambs,

when one day old, are ear-marked, so that there is no chance of making mistakes.

I adopt a cipher system of ear-notching, as shown in fig. 704. Metal ear-tags are

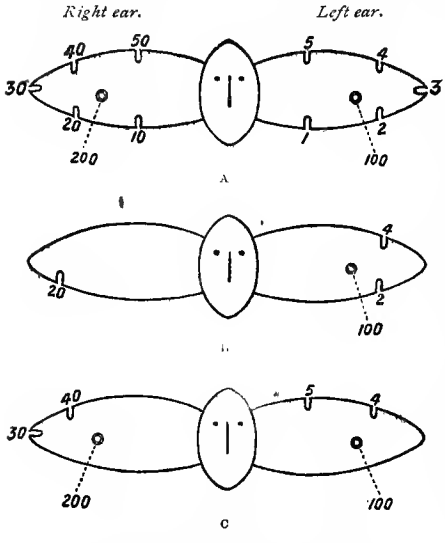


Fig. 704.—*System of ear-marking sheep.*

Diagram A shows the system whereby the numbers are marked on the ears, the units being on the left and the tens on the right ear. Numbering up to other 200 could be obtained by forming another hole near the middle of the right ear. Diagram B shows the marking for No. 126, and Diagram C for No. 379.

not satisfactory; they often cause festering, and are apt to be torn out, when of course the pedigree of the sheep cannot be traced. It is not necessary to use large ear-notches, as these disfigure the ear. Small notches, ⅛ inch wide, are never noticed, and yet suffice for the purpose.

Mating Rams and Ewes.

I consider this one of the most important duties of the careful ram-breeder. Having culled all old and indifferent breeding ewes during the early autumn, and their places in the flock being now taken by about 50 of my best shearling ewes, I proceed to mate about 1st October, so that the bulk of the lambs will arrive in March. For 260 breeding ewes I generally use about 8 stud-rams.

I erect a pen, with a division for every stud-ram, as is shown in fig. 705.

About 30 ewes at a time are driven into the central pen; each ewe is caught in turn, her pedigree, general type, and form examined, and she is put to the stud-ram which is strongest in her weak points, and which we consider will make the best match.

A robust ram will easily serve 60 ewes: some of my rams get 60 and others only 20—according to the suitability of the mating. It is only by careful mating that a uniform flock—all of one type—can be bred.

It is also important to adhere to the same line of blood, which can be done without in-breeding. Violent out-crosses are dangerous, and rams, the produce of

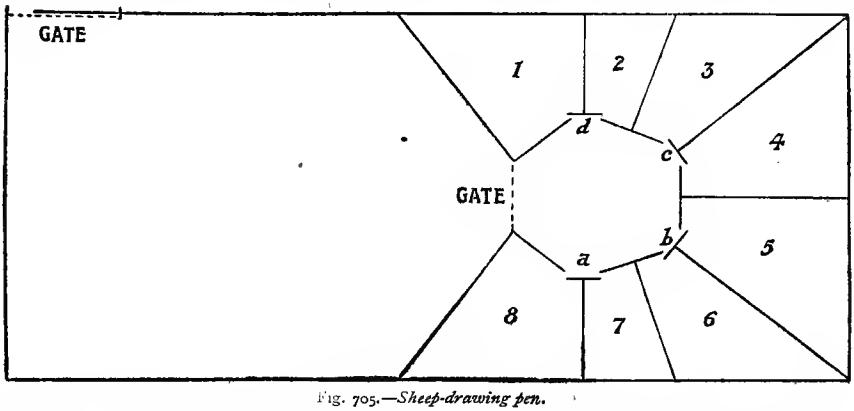


Fig. 705.—*Sheep-drawing pen.*

such, are not likely to be impressive sires.

After mating, each ram with his selected group of ewes is sent to a separate pasture-field.

All the rams have their briskets

smeared first with "yellow" paint, so that the ewes will be marked on the rump when served; when a third of the total number of ewes are marked yellow, "red" paint is used, and when two-thirds are served, "blue" paint is substituted.

This changing of colours serves a double purpose: it is only necessary to take in one-third of the ewes at a time to the lambing-fold in the order in which they were served, and it also shows if the rams are settling their ewes. If the ewes turn twice they must be given to another ram that is a sure stock-getter.

All the ewes ought to be settled in lamb in four or five weeks, but I leave the rams with them till about 1st December in case of any late ones turning.

Treatment of Ewes.

The ewes have the run of the pastures all winter. About 1st January, or earlier if the weather is severe, I begin to give them a few fresh Aberdeen-yellow turnips on the pasture. The turnips are driven out and cut into finger-pieces with Allan's turnip-cutting cart. I find when they are thus cut that fewer turnips are required; the ewes thrive much better, and live longer, as their teeth become badly broken with whole turnips, especially in frosty weather.

Each ewe also gets from ½ to ¾ lb. of a mixture of distillers' dried grains, bruised oats, and linseed-cake, also clover-hay in racks.

It is a great mistake to let ewes in lamb have too many turnips; they should rather be encouraged to eat a larger proportion of fodder or dry food. They should never get more than 20 lb. each per day, or say 1 ton to 130 ewes.

In-lamb ewes ought to be treated so that they will come to the lambing-fold in fine, healthy, robust condition,—neither too fat nor too poor,—and it is important for the flockmaster to watch the general condition of his ewes as the lambing season draws near, because in some cold, changeable, wet winters ewes require more extra keep, whereas in fine, dry winters they are apt to get too fat.

It is by constant care and observation that success is attained, and by lack of it that so-called "bad luck" during the lambing season occurs.

Lambing Season.

Ewes carry their lambs on the average 21 weeks, and a day or two before the first ewes are due to lamb, I draw out all those marked "yellow" and put them in a clean pasture as close to the lambing-shed as possible. The lambing-shed is large enough to hold 100 ewes comfortably at night, when they can be conveniently and thoroughly attended to by the shepherd. The ewes run out all day, and are only housed at dark,—getting all their feed outside.

When a ewe lambs, she and her lambs are shut up in a small pen, 6 feet square, for a day or so, till they are seen to be going on all right, and the lambs getting plenty of milk, when the lambs are ear-marked, as already explained, and they are turned out to another field with natural shelter if possible. I do not believe in housing them again if the weather is at all moderate; if lambs are getting plenty of milk they will stand severe cold.

I keep the ewes with twin lambs in separate fields from those with single lambs, when the doubles can be better done to. When I get about 30 doubles out, they are sent on to a more distant field to make room for a younger lot, and so on. Lambs thrive much better when in small lots.

Strict attention should be paid to cleanliness in the lambing-shed, and plenty of disinfectants and antiseptics used.

After lambing, the ewes get as many cut turnips as they will eat, and their concentrated food is also increased to 1 lb. per ewe. This treatment is continued till there is plenty of grass, when the trough-food is considerably reduced, as the ewes get too fat.

Lambs are weaned about 1st July; the ewes are put on the worst pasture in order to reduce them somewhat, till about 1st September, when they again get better keep to bring them into proper condition for the rams.

Feeding of Lambs.

The lambs, on the other hand, are put on the cleanest and best pastures, and get about ¼ lb. each of a mixture of linseed-cake, bruised oats, and bran. It

is very important to keep lambs at this time from getting affected with stomach and lung worms, and there is no better preventive than changing their pastures frequently and keeping them as much as possible on young pasture. Old pastures should be avoided. Every endeavour must be made to keep lambs growing and improving.

About 1st August the ram lambs, having by this time been separated from the ewe lambs, are folded on vetches or early cabbage for part of the day, running on clover aftermath at night.

When the pasture fails, they are kept folded on cabbage, and later on thousand-headed kale, with an allowance of concentrated feeding-stuff and hay.

About 1st November, before the kale is finished, they get a feed of pulped roots and chopped hay, and they are gradually worn on to a full feed of pulp as the kale becomes exhausted.

They are fed entirely on pulp during the winter and spring.

The most convenient and economical mode of consuming vetches, clover, cabbage, thousand-headed kale, &c., by sheep is by using folding hurdles (fig. 121, vol. i. p. 117). These hurdles are placed close up against a row of cabbage, &c., and the sheep eat through the bars of the hurdles, thus getting their feed clean and not being able to trample on and soil it. One row is eaten at a time, and a man will easily move 50 of these hurdles in 10 minutes.

The ewe lambs get the run of the best pastures till about 1st November, when they also are fed on pulped roots and chopped hay, with an allowance of ¼ lb. each concentrated food mixed in the pulp.

Pulped Food for Sheep.

One very important advantage gained by pulping food for sheep is that the sheep always get a clean, fresh feed instead of a bellyful of cold, watery turnips, which are often dirty and frozen in the ordinary way of folding. Turnips, which are a most expensive crop to grow, are economised, and a larger proportion of fodder is consumed, thereby making the ration more natural and richer in feeding value.

Nothing is wasted, and more sheep can be kept on the same quantity of turnips. The percentage of deaths is very much less.

Feeding-boxes.

Feeding-boxes should be regularly shifted a few yards every day, so that the whole ground is equally manured. The best feeding-box for sheep is made of a pentagonal shape, as in fig. 706. At one of these boxes 10 large sheep or 15 hoggets can feed comfortably; the food is not thrown out and wasted, as it often is with long, narrow troughs; and

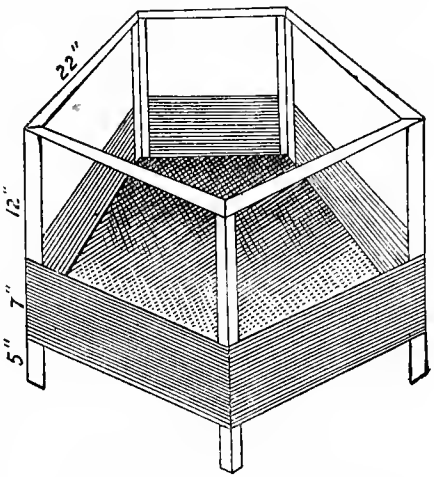


Fig. 706.—*Feeding-box for sheep.*

the sheep cannot crush each other, which is an important consideration in the case of ewes heavy with lamb.

Young Rams.

About 1st March I commence to shear my young rams; they are then kept in large, airy sheds till the wool grows sufficiently so that they can be turned out to grass about 1st May.

The swedes being by this time nearly exhausted, the young rams get a feed of pulped mangels instead, and when young clover and vetches are ready to cut they are gradually turned on to them for summer feeding.

Ewe Lambs.

About 50 of the best ewe lambs are selected to be put into the flock, and these are not shorn till 1st May. The

remainder are treated in much the same way as the rams, and are sold throughout the summer and autumn. Many of them go to foreign and colonial buyers; whilst a large number of the rams are sold for crossing with Border Leicester, Cheviot, Half-bred, Cross-bred, and other ewes, with which they produce the best quality of fat lamb and butchers' sheep.

Prevention of Foot-rot.

In the prevention of foot-rot much depends on the shepherd. On seeing a sheep go lame he should at once examine and carefully dress the affected feet to keep the disease from spreading, and if several show signs of lameness, the whole flock should immediately be passed through a shallow trough containing a solution of arsenic — 1 lb. to 3 gallons of water, or a solution of sulphate of copper—1 lb. to 1 gallon.

Solution for Foot-rot.

Boil 2 lb. of arsenic with 2 lb. of potash (pearl-ash) in 1 gallon of water over a *slow* fire for half an hour; keep stirring, and when like to boil over pour in a little cold water; then add 5 gallons of cold water.

Put this solution to the depth of 1 to 1¼ inch, just sufficient to cover the hoofs of the sheep, in a trough 12 feet

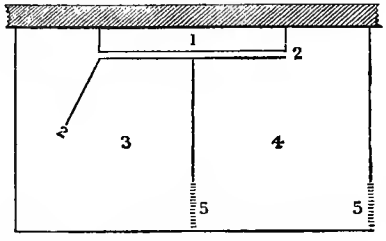


Fig. 707.—*Trough and pens for foot-rot dressing.*

1 Trough. 2 Fence. 3 First pen. 4 Second pen. 5 Gates.

long, by 18 inches wide, and about 6 inches deep—the trough to be set *perfectly level* along the side of a wall or other fence in some place out of the way, with a good waterproof lid on it, and secured by a padlock to prevent danger from the poison which might be left in it. A convenient arrangement for this trough is shown in fig. 707. There should also be a wooden fence on the other side of the trough, carried out a little at one end to conduct the sheep into the trough as indicated in the figure.

Before the sheep are passed through the trough their feet should be well pared; then walk them quietly through, and let them remain in the second pen twenty minutes or so before taking them back to their pastures.

THE HAMPSHIRE DOWN.

Amongst contemporary breeds there is no more striking evidence of progress recorded than in the Hampshire Down. This sheep is for the most part quartered in Wiltshire and Hampshire, although it exercises influence over a wide area beyond these counties. The first step forward made by breeders collectively was in 1861, when they induced the Royal Agricultural Society and the Smithfield Club to provide the breed with a separate classification. Prior to that date Southdowns were the only breed thus honoured, the other Downs being shown in an inclusive class.

The Hampshire Down is largely reared on the high-lying and barren uplands of chalk in the south-western counties, where the flocks, as a rule, are large, numbering from 1000 upwards. Where the custom of the district is to keep smaller flocks than the figure named, it will generally be found that the Hampshire Down flocks are in excess of the other breeds in point of numbers.

Characteristics.

Early Maturity.—The great claim which breeders make, and have rightly established, on behalf of the breed is that it matures early. Indeed there is no Down or other breed which has so much advanced the cause of speedy maturity, and therefore of quick turnover. The pioneer work of the late Mr A. de Mornay must be remembered in this connection.

Weight of Hampshire Lambs.—A well-bred Hampshire lamb on good keep will grow at the rate of ¾ lb. daily, and will weigh 113 lb. on May 31. Calculating the carcase-weight at

60 per cent of the live-weight, we get an average of 17 lb. per quarter. That figure is very frequently exceeded, and 20 lb. at the time of sale a little later in the season is not uncommon. The chief claim made on behalf of the breed is that it progresses with amazing rapidity. The fact that the lambs come to such heavy weights in July and August is striking testimony to the progressive policy of breeders.

Examples of Precocity in Breeding.—The late Mr A. de Mornay, in the course of an article in the *Farmer and Stockbreeder Year-Book*, gave the following instances of the precocious instinct in the Hampshire Down: "Three ewes, each having two lambs by their side, were tupped by one of the lambs in the flock, which could not have been more than three months old. They gave birth to six more lambs in August, one having three lambs.

"Another example of this precocious and prolific instinct may be mentioned in the case of a ewe which gave birth to two lambs in January. She lambed again early in July, when she gave birth to two more lambs, and in January following had again two lambs, making in all six lambs in twelve months. The first two were ram lambs, and were sold at Oxford Fair for 14 guineas. The two young lambs were sold at Wallingford market for £4, and the lamb ram of the last couple was also sold at Oxford, and brought 6 guineas, making £25 for five out of six lambs. The sixth, being a ewe lamb, was saved for stock."

Constitution.—No doubt need be entertained concerning the constitution of the Hampshire Down. *Prima facie* evidence of capacity to endure hardship is afforded by the bare and somewhat bleak downs which they have made their home. Reverting to the very severe winter of 1894-95, it may be pointed out that the tegs from nine to twelve months old lived through that time on partially rotted turnips and hay without the aid of supplementary feeding of any kind. Flocks are frequently brought through the winter without loss by death, and save at the troublesome time of lambing, losses are seldom encountered.

It is the usual custom to sell ewes at four and a half years old, or in the early autumn when they have borne their third set of lambs. There are favourite ewes in most flocks, however, and they continue fruitful up to fourteen years old, cases of the latter age being on record.

Breeding from Lambs.

Mating.—Lambs of six or seven months old are preferred by flockmasters as sires, and ewe lambs may be put to the ram to produce lambs as yearlings. This is one of the means adopted of breeding early maturity into the flock. At the same time, it involves a certain amount of risk. As a rule, the lambing is more difficult, and the ewe's growth is stunted.

One method favoured by many breeders is to breed from a twin lamb. They have the reputation of being more fruitful, and unlike the custom with some other breeds, a large percentage of twin lambs is encouraged. Probably a correct estimate of the lamb-producing capacity of the Hampshire Down would be a lamb and a quarter.

Early and Rapid Breeding.—With regard to the possibility of getting lambs from ewes in the first year of their existence, and the possibility of getting two crops of lambs in the year from the whole flock of ewes, the late Mr de Mornay's views are interesting. "It may," he writes, "in general terms be said that on the same area of land a saving would accrue in the reduction of the flock of ewes, the ewe tegs being productive the first year and the ewes producing a second crop of lambs. A saving would be effected in consequence of the rapid growth and feeding of the second crop of lambs, which would be reared in the summer on the succulent green crops and fed with little cake and corn. On the other hand, account would have to be taken of the extra amount of food required to nourish the tegs during the period of their gestation.

"It is difficult to get at the exact amount of artificial food given to the different flocks on the farm; but, as near as I could ascertain it, in regard to the ewe lambs it amounted, for the eight or nine months from their birth to the

time the ram lamb was introduced, to about 28s. per lamb, and during the period of gestation from 5s. to 6s. per lamb; and in regard to the wether lambs until they were fat, about 35s. per lamb, according to the quality of the hay. With good hay less artificial food is required."

For Crossing.—The Hampshire Down is one of the parents of the Oxford Down. It has been singularly successful when used for crossing. The ram trade is to all intents and purposes a lamb trade, large numbers of ram lambs being sold in the Midlands and the eastern counties of England to beget stock for supplying an immense business in fat lamb. One of the first to demonstrate the possibility of the Hampshire Down for cross-breeding was Mr Thomas Rush, whose series of successes with lambs and wethers of the Hampshire-Oxford Down cross at Smithfield and other fat stock shows did much to popularise the use of both breeds.

Mutton.—The quality of the mutton is of the very best. Nothing handles more kindly than a well-nurtured lamb fatted for the fat stock shows. Dark mutton is always in request.

Fleece.—The wool of the Hampshire is of medium length. It is dense, and fills the hand well. Tegs will clip from 12 to 14 lb. of unwashed wool, the ewes, of course, yielding a smaller return.

Description.

A well-set Hampshire Down is a smart, even gay sheep. It carries a dark strong head, free from horns or "slugs." Speckle faces are not recognised. The poll is well covered with wool, which should intrude upon the forehead. The neck must fill the hand in the case of a sire. Many breeders insist on two strong points in the Hampshire—a big neck and a strong dock, the latter indicative of well-sustained vertebræ. The carcase is symmetrical and square, not cylindrical. The ribs must be well arched, and the loin flat and well packed. The rump should be wide, and the legs of mutton well carried down. The skin should be pink. The following is a scale of points drawn up by the Hampshire Down Sheep Breeders' Association :—

Scale of Points.	Points.
Head.—Free from horns or snigs; face and ears of a rich dark brown—approaching to black—absolutely free from white specks and well covered with wool over the poll and forehead; intelligent bright full eye; ears well set on, not drooping, fairly long and slightly curved towards tip. In rams, a bold masculine head is an essential feature	20
Neck and Shoulders.—Neck of strong muscular growth, not too long, and well placed on gradually sloping and closely fitting shoulders	20
Carcase.—Deep and symmetrical, with the ribs well sprung, broad straight back, flat loins, full dock, wide rump, deep and heavily developed legs of mutton and breast	30
Legs and Feet.—Strongly jointed and powerful legs of the same colour as face, set well apart, the hocks and knees not bending towards each other; feet sound and short in the hoof . .	15
Wool.—Of moderate length, close and fine texture, extending over the forehead and belly, the scrotum of rams being well covered	10
Skin.—Of a delicate pink and flexible .	5
Total	100

Shepherds' Competitions.

One of the contests inaugurated is that for shepherds. Prizes are offered to those shepherds rearing the largest number of lambs. In 1906 thirty-two entries were received, involving a total of 15,248 ewes and 17,742 lambs. The gross number of lambs reared was 116.35 per 100 ewes. The gross average loss of ewes (including barren or other ewes sold to be killed) was 1.77 per cent. The highest percentage of lambs reared was 132.25.

In another competition twenty-seven shepherds reared their flocks without loss of tegs and shared the prizes. The entries numbered fifty, the ewe tegs aggregating 9180 and the total loss 37, equivalent to a percentage of .40.

Flock-Book.—The Hampshire Down Sheep Breeders' Association was established in 1899, when it issued its first Flock-Book.

Foreign Trade.—A foreign trade has been established, and from several parts there is a growing demand.

MANAGEMENT OF HAMPSHIRE FLOCKS.

The system of management pursued in flocks of Hampshire Downs is fairly well

indicated by the following notes relating to Mr H. C. Stephens' famous flock at Cholderton, Salisbury, kindly supplied by the manager, Mr James G. Kerr.

The ewes begin dropping their lambs about the 1st of January, and by the end of the month the bulk of the ewes have lambed, a few late lambs coming in the first and second weeks of February. The lambs are weaned on the 12th of May, or as near that date as possible. The flock being a ram-breeding one, the feeding of the lambs is commenced as soon as ever they will eat out of a trough, and by the time they are weaned they are able to eat ¾ lb. per day of a mixture of feeding-stuff consisting of linseed-cake, peas, and pea-chaff. After weaning beans and locust-beans are added to the above mixture, the quantity being gradually increased until sale time, when they will be consuming 2½ lb. feeding-stuffs per day.

The ewe lambs, after weaning, get ½ lb. each per day of a mixture of linseed-cake and peas. At Michaelmas this is changed to ½ lb. cotton-cake, which they have all through the winter and spring, and is discontinued after shearing in May. After this they get no more feeding till they lamb down in the following year.

With the exception of a few that are sent to the butcher, all the ram lambs are sold for breeding purposes. Breeders of Hampshires prefer to use ram lambs, and at Cholderton all the ram lambs to be sold are sold before they become shearlings. The average price realised in 1908 for all male animals sold, including those sent to the butcher, was £8, 4s. 11d. each, the number sold being 339, the male produce of 612 ewes.

The ewe lambs are all wintered, and a great number are sold for exportation as shearling ewes, at prices ranging from £5 to £15 each, according to the selection of the purchaser. The ewes up to the first of December are penned on arable land, generally on a piece of cabbage, and running on the down for exercise during the day. During December they are removed to a grass lea where cabbages are carted to them, and they still go to the down by day for exercise.

About Christmas Day the early lambing ewes get ½ lb. linseed-cake each per day, which produces a nice flow of milk and helps wonderfully in lambing. As the ewes lamb they are divided into three flocks, consisting of single ram lambs, single ewe lambs, and the twin lambs. The mothers of the single ram lambs receive ¾ lb. decorticated cotton-cake and ¾ lb. bran each per day. The mothers of the single ewe lambs receive ½ lb. decorticated cotton-cake each per day. The mothers of the twin lambs receive ¾ lb. decorticated cotton-cake, ¾ lb. linseed-cake, and ½ lb. bran each per day. In addition to the artificial feeding-stuffs, the ewes have hay, mangels, cabbage, kale, rape, vetches, winter barley and rye, each in its season. After weaning the ewes go to the downs during the day, and at night they are put into pens after the lambs to clear up anything the lambs have left.

The ewes drop the first lamb when they are two years old, and are cast when they have reared their fourth lamb. This is not, however, the general custom. Most breeders only take three lambs, as by this system they get a better price for their cast ewes. But on the Cholderton flock it is found that the old ewes produce the best lambs, hence an extra crop of lambs is taken from them.

Young rams kept for breeding in the Cholderton flock get 1 lb. of cotton-cake each per day, with roots and straw chaff, and as soon as they are shorn they are turned out into a pasture and receive no further feeding. The old stock rams when they come from the ewes are turned out into a pasture, and only receive a little hay in bad weather. If they were given extra food they would get too fat and heavy, and be useless for stock purposes. Only such old rams are kept as have proved exceptionally good stock-getters.

A portrait of a Hampshire ram is given in Plate 53.

THE OXFORD DOWN.

The Oxford Down, like most of our other breeds of farm live stock, is of a composite type. Its origin is not wrapped in obscurity. It is the result of a direct cross between the Cotswold and the Hampshire Down. A few breeders may

have used the Southdown, but the dominant force in the cross was admittedly the Hampshire sheep. After a long series of years of pure breeding, it preserves to this day the characteristics of both parents. The carriage and form of the Cotswold are apparent, whilst the influence of the Hampshire is seen more in the mutton-producing properties.

Early Efforts. — Early last century the possibilities of the Cotswold cross on the Hampshire ewe first impressed Mr Twyman of Whitchurch, Hants. He was undoubtedly the chief of an able band of pioneer breeders, which included such names as Hobbs, Treadwell, Bryan, Stilgoe, and others familiar at the present time. The constitution of the Cotswold sheep has been a particularly valuable asset to the breeder of Oxford Downs.

Characteristics.

The characteristics of the Oxford Down sheep may be thus briefly described. In the ram a bold, masculine head is looked for, with slight inclination to a Roman nose. The neck should be strong and the poll well woolled, with a prominent top-knot. The face should be uniformly dark-brown, the deeper colour being more and more favoured by breeders. There should not be any black wool behind the ears. The eyes should be prominent and the ears a good length. The shoulders should be wide set, the back level, the dock strong. The ribs ought to be well sprung, the barrel thick and lengthy. The underline must be well clad. The legs ought to be short and dark in colour. Spotted legs are objectionable. The sheep should stand squarely on his limbs, which should be, so to speak, at every corner, with twist well developed. The skin should be a healthy pink in colour.

Fleece. — The wool should be dense and of good texture and free from openness, and without spot or patches of black. Short wool should extend down the legs. Rams will clip 14 to 15 lb. and ewes about 8 lb.

Changes in Type.—That the present day Oxford Down is of a different type from that prevailing thirty or forty years ago is evident from the impressions of one of the oldest breeders, Mr John Treadwell. He recollects an old breeder saying that "the Oxford should have the Cotswold fleece and the Down mutton." That, however, soon got out of date. The close fleece was then favoured, and has continued to be one of the primary objects of the breeder. In the olden days the Oxford Down was quite as big a sheep as it is now, but it was "fatter natured." Breeders nowadays look for sheep with more bone than they used to possess, this being probably the most effective antidote to the formation of excessive fat.

In the 'thirties and 'forties of the nineteenth century the common name for the breed was the Cotswold Downs. This was changed to New Oxfords; and finally, when the Breed Society was established in 1888, the modern designation was formally adopted.

Points in Breeding. — The modern tendency is to dispense as far as possible with black wool. As this is usually associated with dark-skinned sheep, the importance of the colour of the skin can be readily appreciated.

Location.—The Oxford Down is true to the county which gave it birth. Flocks are to be chiefly found in Oxfordshire and Gloucestershire. It has, however, gone wide afield. Its most valuable market is the south of Scotland, where it is a prime favourite with owners of whitefaced sheep for crossing purposes. The cross has been unusually successful. Germany takes a number, but the trade with the Continent is fitful.

For Crossing. — The Oxford Down ram lamb is a favourite in the Midlands of England for crossing purposes. It produces not a little of the fat lamb that finds its way to the chief centres of population. Some experiments were carried out in the north of England by Mr W. T. Lawrence of Newton Rigg. The produce of the Oxford Down on the Scotch half-bred ewe (Cheviot-Border Leicester) lambed in March weighed in thirteen weeks 70 lb. liveweight. This weight was attained by double lambs, the singles turning the scales at a similar weight in ten weeks. In 1904 and 1905 further comparative trials were instituted, the competing breeds being Oxford Down, Wensleydale, and Border Leicester. The out-

standing feature of the Oxford cross was that the lambs grew so quickly from birth.

Show Classification. — The Royal Agricultural Society and the Smithfield Club afforded separate classification for the breed in 1862.

MANAGEMENT.

In Oxfordshire rams are put to the ewes on grass-land in August, so as to get early lambs, and it is believed that early lambs are less subject to scour than later arrivals. Clovers are avoided, as they have a tendency to cause ewes to return to the ram. Towards the last month of the year grass-lands by day and root by night, or the reverse, is the rule. Prior to lambing the flock spend the night in the yards. The lambs are drafted on to grass-lands, and are given a few oats, bran, and easily digested foods. Weaning takes place in June, when rye and vetches are ready. The flock is folded on forage crops, the ewes following the lambs from fold to fold.

Mr Treadwell's Flock.

Mr John Treadwell, Upper Winchendon, Aylesbury, Bucks, favours us with the following notes as to the management of his famous flock of Oxford Downs: "This flock being entirely devoted to ram-breeding, is in many respects managed differently from an ordinary flock kept for mutton-producing.

Management of Ewes.—"About the middle of August the ewes are separated into lots, according to their suitability to the different rams to be used; and as many of the sires used are home-bred ones, care has to be taken as to the different pedigrees, as well as to size, wool, and symmetry. This adapting the rams to the different ewes is considered the most important factor in the whole matter of breeding.

"This farm containing a large proportion of grass-land—two-thirds—enables the ewes to be placed in lots as they are drawn in the different pastures.

"About the beginning of November when the ewes are all served they are put together, and clear up mangel-tops, stubbles, seeds, or anything there is for them. When this is done they are again drafted into smaller lots about the pastures, until they come up to the lambing-pen for lambing.

"Rather a large number of rams are used, as some have only a very few ewes and others have a fair number, varying from 10 to 70 to a ram.

"When the ewes come up to the lambing-pen they get a little hay or straw, according to the weather and their condition; and they run on pastures by day. As soon as they have lambed they return to the pastures, and have about 2 pints of cake each, and hay if they require it. The oats are continued until April, when they are gradually taken off, as the grass comes on.

"They are shorn about the end of May, and the lambs are generally weaned in June—the ewes being put to vetches or clover, or a rough pasture, or anywhere where they can be kept cheaply until tupping-time.

"The draft ewes get better treatment at this time. They are fed on the pastures, sometimes getting some cake and corn until they are sold off fat or put to roots or cabbage to finish. These get to very heavy weights if put on roots and brought out in January. They will average about 16 to 18 stone when well finished. Sometimes some of the best of them are sold to breeders in the autumn to keep on another year or two.

Treatment of Lambs and Rams.—"The lambs when weaned are separated, the ram lambs getting a little cake and corn at once. The ewe lambs do not get anything with the grass, as a rule.

"The ram lambs have their cake and corn increased slightly as the season advances, but do not get much attention until after the shearling rams are sold in August, when they are put on to the arable land as soon as some rape or turnips or something can be got for them. They then follow on to swedes and mangels until about the beginning of April, when, if the weather permits, they are shorn, kept in for a few nights, and out in the day, but left out entirely as soon as possible. They get on to rye, and then to vetches, with which they receive mangels until the cabbages come, when these take their place.

"These rams grow very fast and get big by the first Wednesday in August, when about 60 of the best of them are annually sold by auction at home, when buyers from almost every county in England and from many distant countries attend. A few of the rams are sold privately to foreign buyers, chiefly Germans. Then every year a number of rams are sent to the Scotch sales at Edinburgh and Kelso, where there is a great demand for them for crossing purposes—the Oxford ram on the Half-bred ewe answering better than anything else.

"The ewe lambs generally go off the pastures on to rape in October, and then on to turnips, with which they get a little cotton-cake. In the spring about half are selected for the flock, and they are fed on vetches or seeds or pasture until turned into the ewe flock, when the rams are put amongst them. The draft ones are put into the pastures, and sold during the summer for stock or to the butchers, the majority now going to Germany and other countries for breeding purposes. The stock rams are not highly fed."

For many years Mr Treadwell was the leading prize-winner in the Oxford Down classes at National and other shows, but soon after the advent of the new century he discontinued exhibiting. Since then the demand for Mr Treadwell's rams has increased, and so also has the run of prices for them. At the Jubilee Sale in 1907 the average for 58 shearling rams was £23 — with a top price of 150 guineas.

Maisey Hampton Flock.

In the well-known prize-winning flock of Oxford Downs belonging to Mr James T. Hobbs, Maisey Hampton, Gloucestershire, lambs are dropped between the 1st of January and the middle of March. For some time before lambing the ewes get a limited supply of roots and plenty chopped hay and straw. After lambing they get a liberal allowance of roots and good hay, with 1 lb. of corn each per day. After the lambs are weaned the ewes are kept on grass, and they clear up behind the lambs.

The lambs for some time before being weaned are allowed to run in front of their mothers, where they get a little linseed-cake and crushed oats and bran in boxes, sliced roots and hay being also given. After weaning the lambs are usually started on young "seeds" until vetches are ready for them, the concentrated food being continued, with the addition of a little split peas, the quantity allowed being about 1 lb. each per day.

Ewes drop their first lamb when two years old, and are usually cast when they have reared four crops of lambs.

Young rams in winter get roots and hay, with about 1 lb. of corn each per day. They are put on to rye and vetches in spring and summer, their allowance of corn being gradually increased till it reaches 2 lb. each per day. They are generally sold in August.

An Oxford Down ram is represented in Plate 53.

THE SUFFOLK.

The Suffolk breed of sheep has come to the front very much during the closing years of the nineteenth and opening of the twentieth centuries. It is kept in its native county, a few flocks being found in Essex, Norfolk, and Cambridge. It is chiefly in the hands of tenant-farmers.

Origin.—The origin of the breed is not difficult to trace. It was evolved by a cross of the Southdown on the Norfolk horned sheep. The horns were in course of a few generations eliminated. It is curious to note how the predominant features of the old Norfolk breed have asserted themselves. The Suffolk has all its leanness of flesh and darkness of limb and face. It has kept the size of its Norfolk progenitor, on which it has grafted the quality of the Southdown. The cross was made early last century, in the middle of which the breed was commonly known as the Southdown-Norfolks. It was in 1859 that the breed was finally christened the Suffolk.

Characteristics.

The Suffolk is a bare polled sheep, with greater length of limb than most of the other short-wools. It is very dark in the face and on the limbs, jet-black in fact, a characteristic inherited from

its Norfolk ancestry. The eye is bold, the nose fairly long, and the muzzle square. The ears come forward parallel to the poll, and should not droop. In the ram the neck should be very full, and fill the hand when gripped. The back should be broad, and touch kindly under hand. Length of frame is necessary to carry flesh. The whole appearance of the sheep differs from other Down breeds in its bareness of limb and poll. It suggests activity.

Scale of Points.

The following scale of points has been adopted by the Suffolk Sheep Society:—

	Points.
Head.—Hornless; face black and long, and muzzle moderately fine—especially in ewes (a small quantity of clean white wool on the forehead not objected to); ears a medium length, black and fine texture; eyes bright and full	25
Neck.—Moderate length and well set (in rams stronger, with a good crest)	5
Shoulder.—Broad and oblique	5
Chest.—Deep and wide	5
Back and Loin.—Long, level, and well covered with meat and muscle; tail broad and well set up; the ribs long and well sprung, with a full flank	20
Legs and Feet.—Straight and black, with fine and flat bone; woolled to knees and hocks, clean below; fore legs well set apart; hind legs well filled with mutton	20
Belly (*also Scrotum of Rams*).—Well covered with wool	5
Fleece.—Moderately short; close fine fibre without tendency to mat or felt together, and well defined—*i.e.*, not shading off into dark wool or hair	10
Skin.—Fine, soft, and pink colour	5
Total	100

Prolificacy.—The Suffolk is a prolific breed. It is on record that one ewe dropped no less than eight healthy lambs in the brief space of 12½ months. It is interesting to note, as indicative of the prolificacy of the breed, that since 1887, when returns were first made to the Suffolk Sheep Society by the owners of registered flocks, the number of lambs reared has been 132.25 per 100 ewes. Roughly speaking, therefore, one may conclude that the breed is capable of producing a lamb and a third a-year.

Lean Mutton.—The Suffolk more than any other breed has distinguished itself since the carcase contests were instituted at Smithfield Show. No doubt the quality already referred to—the large proportion of lean to fat—has enabled it to excel when the block is the objective. As a show sheep the Suffolk has not quite the width, depth, and wealth of some of the others, hence its absence from representative honours in inter-breed contests.

Produce of Mutton.—Experiments carried out at the Hollesley Bay College with a Suffolk on Merino ewes resulted in a lamb and a half per ewe. This lamb, slaughtered at 15 months, weighed 94 lb. live-weight, and gave a dressed carcase of 54 lb.—equal to 60.64 per cent. The washed fleece weighed 6.65 lb. The winning carcase in the short-wool wether sheep class at Smithfield Show in 1907 was a Suffolk, and so was the second. Weighing 208 lb. on arrival and 640 days old, the carcase-weight was 133 lb., this showing the highest daily gain in the class. The first, second, fourth, and fifth prizes in the short-wool lamb class were also won by Suffolks. The winner scaled 144 lb. 265 days old, killing 92 lb. Still further triumphs, including the championship in the carcase competition, fell to the breed at the Smithfield Show of 1908.

For Crossing.—The breed has been exploited for crossing purposes, particularly in the south of Scotland, where it finds patronage for mating with the whitefaced ewe.

MANAGEMENT OF SUFFOLK FLOCKS.

In the best of the Suffolk flocks a liberal and thoroughly up-to-date system of management is pursued. That this is the case is clearly shown by the rapid progress which the breed has made in regard to early maturity and mutton-producing properties generally.

The majority of the Suffolk flocks are kept on land of poor quality, and in these flocks March is the principal lambing month. The general system of management here is less expensive than in ram-breeding flocks.

Mr Herbert E. Smith's Flock.

In the well-known Suffolk flock owned by Mr Herbert E. Smith, The Grange,

Walton, the lambs are dropped in January and February, and they are weaned about the first of June. Before lambing the ewes run on grass during the day, and are folded on turnips at night, getting also a little hay. After lambing they are folded on turnips, cabbages, &c., and run out on rye; later on they go on to mixed grasses, and get a small allowance of mangels.

After weaning the lambs get about ½ lb. per day of mixed cake and oats, are folded on tares and rape, and have a daily run on clover or sainfoin. The draft ewe and wedder lambs are sold about the second week in July, realising about 50s. each. The ram lambs are sold in August and September, and bring about £20. Young rams are fed well on cabbages, rape, and sainfoin, getting in addition about ¾ lb. per day of a mixture of corn and cake.

The Playford Flock.

In Mr S. R. Sherwood's valuable flock at Playford, Ipswich, the ewes for about a month before lambing get ¾ lb. each per day of linseed-cake and crushed oats and bran, mixed in equal proportions. The lambs are dropped in January and February, and are weaned in April and May. For a time before weaning the lambs run through "creeps" in front of their mothers, and get as much as they care to eat of the same mixture, with cracked peas and beans. Lambs run on turnips, rye, savoys, swedes, and trifolium in succession.

The culled ewe lambs are sold in July at about 50s. to 55s. each, the best being retained for breeding. Ram lambs are sold in August, September, and October, at an average of about £12 each. Young rams are pushed on from the start, getting swedes and savoys mixed, and as much cake, crushed oats, bran, and cracked peas as they will eat.

After weaning ewes are kept for a time on moderate food, but they are gradually put into good condition for tupping in August. Just before tupping they are "flushed" on cole-seed or good grass and stubble. Mr Sherwood does not breed from ewe lambs.

A portrait of a Suffolk ram is given in Plate 57.

THE RYELAND.

The Ryeland breed is one of the oldest English breeds, although perhaps it has not contributed much to the ovine history of the country. It is found chiefly in Herefordshire and Worcestershire. Originally it had an extensive run on the Welsh Borderland, being prized for its wool.

The modern Ryeland is a vastly improved sheep. It can hold its own with any breed for symmetry, closeness of fleece, and firmness of flesh. Breeders freely advertise its suitability for fat lamb production.

Appearance and Weight.—In appearance the Ryeland has something in common with the Shropshire in quality and symmetry, although of course its colouring is a dull white, and it is not so severely muffled on the face. It carries a close, thick fleece of excellent quality. In weight it scarcely attains the scale of the Shropshire, but 10-month-old lambs will turn out as high as 18 lb. per quarter, and wethers at 16 or 17 months will kill 22 lb. per quarter. The old Ryeland breed was a sheep of much smaller frame, and did not fatten so readily as the modern type, which has been increased in weight to the extent of 6 to 8 lb. per quarter, age for age.

Fleece.—A still greater improvement is noticeable in the weight of the fleece, which has been advanced from about 3 lb. to close on 8 lb. in a well-bred flock. The wool of the Ryeland is said to be the best for carding purposes produced in England, and doubtless the competition of foreign wools has affected the popularity of the breed in England.

Management.—There is little that is exceptional in the management of Ryeland flocks. They are treated with enterprise and care.

A Ryeland ram is represented in Plate 57.

THE DORSET DOWN.

This breed, which supports a flock book established in 1906, is native to the south of England. Its origin was

a cross between the Southdown and the Berkshire, Hampshire, and Wiltshire ewes.

Early Improvement.—The earliest exponent of this cross was Mr Thomas Homer Saunders of Watercombe, near Dorchester, who created a type of sheep known as the "Watercombe Breed of Improved Hampshire Downs." He and his son, Mr T. Chapman Saunders, were closely identified with it.

Contemporaneously with the work of Messrs Saunders was that of Mr Humfrey of Chaddleworth, near Newbury. His method was to procure a Webb Southdown ram and cross with the Hampshire and Wiltshire ewes. These sheep were known as "West Country Downs," and were exhibited at the Royal shows at Chester in 1858 and Warwick 1859.

Characteristics.

The Dorset Down is closely related to the Hampshire Down, but is of finer bone and often of lighter colour. A good Dorset Down should be free from coarseness, have a long, full, clean face and under jaw, a bold eye and full muzzle. The ears should be thin, fairly long, pointed, and whole-coloured, being carried well above the level of the eyes. The bone should be fine. The fleece should be dense, growing well down to hocks and knees, round the cheeks, between the ears, and on the forehead. Wool under the eyes or across the bridge of the nose, on the ears, or below the hocks and knees, should be avoided. The face and legs should be of a brown colour. There should be no tendency to legginess.

Early Maturity and Weight.—The breed matures early. The ewes are capable of producing sucking lambs weighing from 40 to 48 lb. at 10 to 12 weeks old, or a well-finished carcase at from 8 to 9 months of from 66 to 72 lb. mutton.

MANAGEMENT.

Flock management in the south of England implies early lambing. The average Dorset Down flockmaster is well content if he rears just over a lamb to the ewe. In the Forston flock Mr Cecil Boatswain writes that, from 400 breeding ewes, in 1908, he reared 385 lambs. Mr G. Wood Homer of Bardolf Manor, Dorchester, reckons that his flock of 580 ewes rear rather more than a lamb apiece.

The mating in Dorset Down flocks takes place early in July, and the lambs are dropped from December onwards. The lambs run with the ewes until not later than the beginning of May. A Dorset Down ram lamb will serve from 70 to 100 ewes. Mr Wood Homer estimates that not more than 8 per cent require second service, and 2½ per cent a third service. There should not be more than 1 per cent of barren ewes.

Prior to lambing, ewes fed on grassland get a few turnips and hay. The increased acreage of land laid down enables flockmasters to keep their flocks on grass. The hay-cribs should be out early in October, and about ½ lb. of hay given to ewes forward in lamb. The quantity is gradually increased, being given in two portions—morning and evening.

When the lambs are a week to ten days old they are put on turnips. The best lambs are pushed forward with cake, and are ready for the first draft early in May, when about four months old. They realise up to about 36s. per head. The second draft comes on in July, making about 33s. The off-going ewes are fit for market in May, making over 50s., and weighing as much as 100 lb. dead-weight.

It is of the highest importance to provide adequate shelter, otherwise the cold winds cause heavy losses. Shelter-hurdles are commonly used for this purpose.

In the ram-breeding flocks selection of the rams takes place about March, and those chosen are pushed forward with extra food. The ewes should be carefully drafted about August.

Mr Wood Homer considers that his couples, Chilver hoggs and fattening sheep, run to about 2½ sheep to the acre on light hill-land. This, however, is possible only by the liberal use of artificial food.

A Dorset Down ram is represented in Plate 59.

THE DORSET OR SOMERSET HORN SHEEP.

The Dorset Horn sheep appears amongst the earliest records of pastoral husbandry in the south of England. As far back as 1757, in his *Observations in Husbandry*, Edward Lisle records that in the course of his journeys into Dorsetshire between 1693 and 1772 he was struck with the fecundity of the native horn sheep. He remarks "that his tenant, Farmer Stephens, had ewes which brought him lambs at Christmas, which he sold fat to the butcher at Lady Day, anno 1707; and at the beginning of June, thinking his ewes to be mutton, they looked so big, he went to sell them to the butcher, who handled them, and found their udders springing with milk and near lambing, and they accordingly did lamb the first week in June."

Again, William Ellis, in his *Shepherds' Guide*, published in 1749, describes the west country sheep as white-faced, with white and short legs, broad loins, and fine curled wool, "the Dorsetshire variety being especially more careful of their young than any other."

There is probably no better or more continuous record of a breed being associated for a long period with a county than this.

Another name for this breed is the Somerset Horn sheep.

Characteristics.

This is a whitefaced horned breed. It is essentially a meat sheep, in some respects not unlike the Cheviot in form, but longer in frame.

The head should be broad, the nostril full and open, the poll well woolled to the brow, the face white, the nose and lips pink. The ears are of medium size and thin. The teeth are flat, chisel-shaped. The neck is short and round, well sprung from the shoulders, and in the ram strong and muscular. The chest is well forward, full, and deep. The fore flank is full, with no depression behind the shoulder. The shoulders must be well laid and compact.

The back and loin should be broad, long, and straight, with deep well-sprung ribs. The quarters must be full, broad, and deep, and fleshed to the hocks. The tail should be well set in a line with the back, wide, firm, and fleshy. The legs must be well planted at the four corners, with plenty of bone, and well woolled to or below the knees and hocks.

The fleece should be compact and firm to the touch, of good quality and staple.

The rams should have a bold masculine appearance, carrying a handsome head, with strong and long horns well apart at the crown, springing out in a straight line with each other, and coming downwards and forwards in graceful curves as close to the face as may be without involving the necessity of having to be cut.

The ewes should have feminine characteristics and a more delicate set of horns.

It is a distinct objection to have a spotted skin or fleece. Markings on the horns are also disliked, while the tendency to grow the horns back is viewed with strong disfavour. The legs should be free from coarse hair.

In the Showyard.—The breed was first afforded separate classification at the Battersea meeting of the Royal Agricultural Society in 1862, the judges reporting limited competition but superior quality. The breed was again exhibited three years later at the Plymouth Royal Show, and subsequently at the Oxford and Cardiff meetings in 1870 and 1872.

Flock Book.—The Flock-Book was established in 1892. The volume for 1907 contains entries of 69,577 sheep.

Fecundity.— As already indicated, the outstanding characteristic of the Dorset Horn breed is its fecundity. The ewes receive the male as early as April or May, and the lambs are born in September, October, and November, the Royal Agricultural Society classifying them to be born 1st November. The lambs are produced early for the Christmas trade. The produce of a flock varies from 130 to 180 per cent of lambs, and in warmer countries two sets of lambs a-year have been bred. Occasionally this is done in this country, but the practice is not favoured.

Early Maturity.—About a ewe and a half are kept to the acre, varying with the quality of the land. The lambs re-

main with the ewes until May. The general lambing time is about two months in advance of other breeds, the flock ewes dropping about Christmas. The earlier lambs receive good feeding, the object being to fatten them as quickly as possible. October or November lambs, well nurtured, will be ready for the butcher at from ten to twelve weeks old, averaging from 10 to 14 lb. per quarter. They find a market in London at prices reaching up to 50s.

Dorset ewe lambs have been bred from under twelve months old, the rams being used on them in November and December. Their produce is fit for the butcher by midsummer.

For Crossing.—The Dorset Horn has not been used extensively for crossing. The most general cross is the Horn ewe and a Down ram, producing a very good grazing sheep, which may be fattened off pasture at eighteen months to kill from 20 to 25 lb. per quarter.

Where the Breed Thrives. — The breed is of course native to Dorset. It flourishes on the chalk farms of the Isle of Wight and Isle of Purbeck, and from Dorchester to Bridport, Crewkerne, and into the richer lands of Somerset and Devon. In the west of England it produces the early "house" lamb. Morton's *Cyclopædia of Agriculture* mentions the Horn sheep of the west of England as one of the oldest and best of the upland short-woolled Horn races. The breed has also, on a small scale, been tried in Scotland and Ireland.

The Somerset Horn Sheep.—This sheep was at one time bred on divergent lines to the Dorset, although they are of common parentage. Somerset breeders claim to have introduced the pink nostril as opposed to the dark. The Somerset sheep in the earlier times was lankier than the Dorset variety, but by judicious crossing greater plumpness and better form have been gained. Spooner says: "The Somerset sheep is a variety of the Dorset, possessing the same peculiarities and differing from it in being larger and taller, and having more arched profiles and heavy pink noses instead of black and white."

Clip.—The lambs clip from 2½ to 3 lb. of wool; the ewes from 5 to 7 lb., and the shearling rams from 10 to 14 lb. The particular virtue of the wool is its whiteness and the fine point it possesses.

MANAGEMENT.

The management of a Dorset Horn flock is naturally determined to some extent by the period when the lambs are marketed. If very early lambing is the case, say in October and November, naturally Christmas lamb is the chief object. In the main, however, fat lamb is turned off from the month of April up till Christmas. A general lambing time is in November and December. This necessitates early ram sales, which take place in summer. One of the objects of the Dorset Horn flockmaster is to get his lambs forward to the London market before the Down breeder is ready with his consignments.

The wintering of the flock is very much like that of flocks of other breeds in the south. The root crops—mangels and turnips — play an important part, with plenty of hay to counteract the watery character of the roots. The twin ewes are specially fed, as they have a larger family to bring up, cake and corn being the chief ingredients of the artificial food mixture. Peas and old beans are also used. Mr James Attrill, who has a flock in the Isle of Wight, declares that "nothing fattens a lamb so quickly as plenty of milk." It pays, therefore, to look well after the ewes.

Mr Samuel Kidner's System.

In Somersetshire the system prevailing may be described in the words of Mr Samuel Kidner of Bickley, Milverton: "The breeding flock," he says, "consists chiefly of three ages, but a few of the best are retained for the fourth crop. The percentage of twins dropped would be about 66 per cent, with a few triplets last season, 3 per cent. The tupping begins about the first week in July, a few lambs being born in the last week of November, but the chief crop through December. None of the lambs are fattened, but are kept in a healthy growing state. The twins are kept separate, with more liberal treatment.

"Weaning takes place in about three

months from birth, when those to be kept for rams are selected. The lambs are then kept on cut swedes until we have green food for them, some linseed-cake being given. The over-age ewes are put forward as early as possible, being usually fit for the butcher when their lambs are weaned, there being always a demand for this class of sheep up to Lady Day.

"The wether lambs are maintained in store condition through the summer, in early autumn kept better, and sold at from twelve to thirteen months old, fat. The ewe lambs are selected for the flock in the autumn, there generally being a demand for the draft lots for breeding purposes. The rams are sold in their wool as yearlings about the second week in May."

Mr F. J. Merson's Flock.

Mr Frank J. Merson of North Petherton, Bridgewater, mates his ewes twice, as two tooths and four tooths. Thereafter a few of the best are retained in the flock as six-tooth ewes. The latter are put to the ram about the end of May to bring fat lamb, the progeny being fattened along with the ewes. The Chilver lambs from the younger ewes go into the flock, and a few of the best ram lambs are kept as tups. After lambing the flock is kept on grass for about six weeks, with cake, corn, and hay; and then on roots, rape, kale, and cabbage; finally, white turnips and cut swedes. The ram lambs run forward through "creeps." Fat lambs generally make from 35s. to 40s., fat ewes from 50s. to 55s., and fat hoggs up to 60s. There are about 50 per cent of twins. The ewes clip about 6 lb. and the ewe hoggs 7 lb., lambs 3 lb.

A Dorset Horn ram is represented in Plate 59.

RADNOR SHEEP.

This breed is associated with the county after which it is named. It has extended farther afield than that, however, being found on the Montgomery and Merioneth hills. The type has not been constant, being subject to extraneous influences which have altered it considerably.

Characteristics.

In point of colour some of the Radnor sheep are tan, some grey, and some speckled in the face. At one time their faces were yellow or, as they prefer to call it locally, tanned. Their fleeces were short and close, and they were built on short legs. They were well suited to resist the rough climate of the hills.

When the Radnorshire hills were fenced off, and the plough invaded what was hitherto the domain of the sheep, an effort was made to increase the size of the breed, Shropshire blood being introduced. This produced a hardy, clean-limbed, somewhat long-faced sheep, rather darker in visage. Latterly the Kerry Hill ram has been used extensively, and the time does not seem far removed when it will be difficult to distinguish between the two.

In appearance the modern Radnor is black of countenance, though some are tanned or grey. The rams are horned and the ewes should be polled. They are short-legged sheep, somewhat slow feeders, but their mutton is of excellent quality. When three or four years old the wethers will weigh from 14 to 15 lb. dead-weight per quarter, and clip from 4 to 5 lb. of wool.

The ewes are good nurses, and are largely used in the rearing of fat lamb.

MANAGEMENT.

At one time it was the custom to sell off the wethers when three or four years old, the wool paying for the sheep's keep. The cost of feeding was small. Nowadays the wethers are sold off at a year and a half to go on to Midland pastures, where they rapidly fatten and command a good price. The drafting of the ewe flock is done annually, and two- and three-year-old ewes are much in demand in September for the production of fat lamb.

The ewe flocks kept are much larger than formerly, owing to the disposal of wethers at an earlier age.

MOUNTAIN AND MOORLAND BREEDS OF SHEEP.

BLACKFACE SHEEP.

The early history of the Blackface sheep is pretty much a matter of conjecture. One eminent writer, Dr Walker, supposes that it is of foreign origin, and that the forest of Ettrick was selected as its first locality in Scotland. He mentions that a flock of 5000 sheep was imported by one of the Scottish kings, and from that stock the whole of the Blackface race, it is supposed, succeeded.

Other writers maintain that it originated among the mountains of Cumberland, Westmoreland, and Lancashire. Some people hold, on the other hand, that the Blackface had its rise among the mountains of southern Scotland. One Hector Boethius, writing about 1460, and speaking of sheep in the vale of Esk, says: "Until the introduction of the Cheviots the rough-woolled black-faced sheep alone were to be found."

It is therefore pretty certain that from time immemorial it has held undisputed possession of the hills of southern Scotland and north of England.

The introduction of the breed to the Highlands of Scotland, which took place about the middle of the eighteenth century—when black cattle began to give way to sheep—was not altogether welcomed. In the Highlands at that time was a small white breed carrying a fine fleece, and its admirers felt sadly grieved over the inroads of the hardy Blackface. A Dr James Anderson, writing regarding the improvement of wool in the northern counties, says: "The coarse-woolled sheep" (meaning the Blackface) "have been debasing the old breed under the name of improving it, so that I am inclined to believe that in the mainland of Scotland the true unmixed breed is irretrievably lost." Since the beginning of last century, when flockmasters began to direct attention to the improvement of the breed, many defects have been removed. In modern times a healthy emulation and enthusiasm have taken possession of sheep-farmers to raise the value of their flocks, and of recent years a marked improvement in the character of the Blackface has been accomplished.

In many parts of the country the Blackface has been supplanted by the Cheviot, owing to the better price obtained for the wool of the latter.

Distribution of Breed.

The localities most noted for this breed are Lanarkshire, Ayrshire, Mid-Lothian, Perthshire, and Stirlingshire. Lanarkshire may be said to be the nursery of the Blackfaces, thousands of lambs being transported annually from this county to be reared upon the extensive pastures of the more elevated districts.

The southern districts of Scotland, as a rule, raise the best stock, being the districts in which the spirit of improvement has been longest and most actively at work. In the counties of Lanark, Ayr, Dumfries, and Mid-Lothian great pains and attention have been bestowed on the breeding process for a long period. The northern counties, though at one time behind, have been rapidly coming to the front during recent years.

In the more northern districts of Scotland extensive tracts abounded unconnected with any breeding farms, upon which the stock of wethers were maintained by buying in lambs.

Towards the end of last century, a demand having arisen for younger mutton, the grazing of three years became unprofitable, and the land had to be devoted to other purposes.

In the southern districts a ewe or breeding stock prevails; while in central and northern Scotland a mixed stock, ewe and wether, is the general rule.

Characteristics.

Strongly defined and distinctive characteristics and peculiarities distinguish the hardy Blackface. The general form is robust, muscular limbs with wide chest, body short and well barrelled, face and legs black and white or entirely black in colour. Endowed with great animation, the slightest alarm rouses them to action. Both sexes have

horns,—large and spirally-twisted in the male, small and flattish and standing more out from the head in the female.

The wool is long and wavy, somewhat coarse, inclining to hairy.

Wild and restless in their habits, the nature of the sheep is to climb the highest hills. Remarkably hardy of constitution, they endure hunger and cold to a wonderful degree, boldly wintering it out where other breeds would succumb, and working with their feet among the snow for a bare subsistence with an energy and determination truly surprising. Their powers of endurance under the most trying circumstances is marvellous, instances being on record where some of the breed after being buried under snow-drifts for three or four weeks came out alive and apparently wonderfully well.

Strong in maternal or "homing" instinct, with a special attachment to a certain locality, ewes have been known to travel long distances so as to produce their offspring at the favoured spot.

Their mutton is so delicate and finely flavoured that it is preferred to every other.

An important property of this breed is its adaptation to heath lands; and it is this property that has rendered it so suitable to the extensive tracts of heath-covered hills throughout the country where it is acclimatised. There are many extensive Blackface sheep-runs, ten to fifteen thousand acres not being uncommon, with flocks of from five to eight thousand.

A Typical Blackface Sheep.

The following points are considered essential in a good specimen of the breed: Broad muzzle with strong aquiline nose and wide nostrils; forehead wide and full; the colour of the face to be either entirely black or black and white distinctly defined; both face and legs to be clean and free from all dunness or tuftiness; horns hard and free from blood-red, inclined to be wide set and not rising high on the crown, but coming out level with the top of the head, assuming a spiral formation; shoulder broad, with wide chest; straight broad back, not drooping behind; erect on hind legs, which should be well apart. The flow of the wool should almost reach to the ground.

The Blackface ewe is in good demand for crossing purposes — that with the Border Leicester proving very successful. The lambs, the result of this crossing, are excellent feeders, coming quickly to maturity, and yielding mutton of a high character and fine flavour.

Weights. — A well-known breeder gave the following as the average dead-weight of the various classes of Blackface sheep taken off the hill:—

3-year old wethers	from	14	to	16	lb.	per qr.
2-year old do.	"	12½	"	14	"	"
Yeld ewes	"	13	"	15	"	"
Gimmers	"	12	"	13½	"	"
Cast ewes	"	10	"	12½	"	"

Prices of Blackface Sheep.

The following are the general prices for Blackface wethers and cast ewes in each of the years 1893-1907:—

	Wethers.				Cast ewes.			
	s.	d.	s.	d.	s.	d.	s.	d.
1893	21	0 to	37	0	12	0 to	24	0
1894	20	0 "	37	6	14	6 "	26	6
1895	23	0 "	41	0	16	0 "	28	6
1896	19	0 "	35	4	13	0 "	24	0
1897	21	0 "	36	6	15	0 "	25	6
1898	22	0 "	37	0	16	0 "	26	6
1899	20	0 "	33	6	13	0 "	24	0
1900	23	0 "	36	0	16	0 "	26	0
1901	20	0 "	35	0	14	0 "	25	6
1902	18	6 "	34	0	12	0 "	24	0
1903	21	0 "	36	0	15	0 "	28	0
1904	23	0 "	38	6	18	0 "	30	0
1905	21	6 "	37	0	19	0 "	31	0
1906	23	0 "	38	0	20	0 "	33	0
1907	21	0 "	33	6	17	0 "	28	0

Prices of Wool.

The following are the prices per stone of 24 lb. of unsmeared wool of Blackface sheep for the years 1893-1907:—

	s.	d.		s.	d.
1893 from	10	0	to	12	0
1894 "	10	0	"	12	0
1895 "	10	0	"	11	6
1896 "	10	0	"	11	6
1897 "	10	6	"	12	0
1898 "	10	0	"	11	6
1899 "	8	6	"	9	6
1900 "	8	0	"	9	6
1901 "	8	0	"	9	0
1902 "	8	6	"	9	6
1903 "	11	6	"	12	6
1904 "	14	0	"	15	0
1905 "	15	0	"	16	0
1906 "	16	0	"	17	6
1907 "	16	0	"	17	0

MANAGEMENT.

The management of the Blackface is, generally speaking, pretty much the same all over, varying little from north to south. On most farms the flocks are allowed to roam at free will. There are some farms, however, on which the flocks are divided into what are termed *hirsels*, each hirsel being confined to a certain portion of the farm.

The ewes have their first lambs at two years old. The rams are put to the ewes between 20th and 30th November, and the lambs are dropped towards the end of April.

During winter these Blackface sheep live on rather scanty fare,—auxiliary feeding being resorted to only when the ground gets covered with frozen snow to such a depth that they are unable to get at the herbage by scraping with their feet. Flockmasters in high exposed districts consider it necessary to keep a supply of hay in reserve against a protracted storm, as judicious feeding at such a time becomes indispensable.

The male lambs are castrated when about eight or ten weeks old, the best being left uncut for sires.

The fleece is removed in the months of June and July, the male and yeld portion of the flock coming to clipping condition earlier than the breeding ewes.

It is the custom on many farms to wash the sheep before clipping them. In the shearing operations mutual assistance is frequently given. Neighbouring shepherds help each other during the clipping. The sheep are generally branded or marked with tar after the fleece is removed.

The fleeces are rolled up and packed ready for sending to market. The average weight of the fleece is between 4 and 5 lb. The wool being inferior in quality to that of other breeds is chiefly used in the manufacture of carpets and the coarser fabrics. The clip is consigned to wool-brokers in the large towns, who dispose of it by auction, at prices ranging over a series of years, from 4d. to 8d. per pound. America is a good customer for this class of wool.

Within recent years there has been a tendency to favour the production of large, heavy fleeces of strong wool, although some breeders lean to the opinion that the advantage to the animal lies with the thick-set soft wool evenly distributed.

The lambs are weaned about the second week in August. The ewe lambs, with the exception of what have to be retained to keep up the numbers of the stock on the farm, are sold for breeding purposes. The wether lambs are disposed of according to the nature of the farm. Where a mixed stock is kept the best of the wether lambs are retained till two or three years old. Only the inferior class, or what are called *shotts*, are sold. Where only a ewe stock prevails the whole of the wether lambs are sold. They pass into the hands of low country and arable farmers, who, after feeding them for a few months, generally dispose of them at remunerative prices.

Hoggs on the majority of grazings are sent sometimes long distances to the country for wintering. This proves an expensive item in the economy of sheep-farming, the cost averaging from 7s. to 8s. a-head.

The old or cast ewes—that is, all above five years or so—are drafted in October, and sold for rearing a crop of cross lambs, after which they are fattened for the butcher.

Dipping.—The process of dipping hill and other sheep is universally practised, being for a time made compulsory by legislative enactment. It consists of a bath composed of certain ingredients, administered twice a-year. This is for the purpose of destroying parasites and the prevention of skin diseases, promoting the general health and comfort of the animal, as well as enhancing the quality of the wool.

Markets.—The principal markets for the sale of the Blackface are the various auction marts throughout the country, the once famous Falkirk Trysts now being a thing of the past. A sheep and wool fair is held at Inverness in the month of July. This market is unique of its kind, there being neither a sheep nor a fleece on view, all purchases being based on previously proved character.

Qualifications of a Shepherd.—Farmers place their flocks under the care of trustworthy and capable shepherds. At all seasons interested shepherds can

by care and judgment do a great deal in improving the condition of flocks. Mr Little, a writer on the subject, gives the following qualifications of a mountain shepherd: "The shepherd should be honest, active, careful, and, above all, calm-tempered. A shepherd who at any time gets into a passion with his sheep not only occasionally injures them, but acts at a great disadvantage both in herding them and working among them. A good-tempered man and a close-mouthed dog will effect the desired object with half the time and trouble that it gives to the hasty, passionate man. The qualifications of a shepherd are not to train his dog to running and hounding, but to direct the sheep according to the nature of the soil and climate, and the situation of the farm, in such a manner as to obtain the greatest quantity of safe and nutritious foods at all seasons of the year. Those shepherds who dog and force their flocks I take to be bad herdsmen for their masters and bad herdsmen for the neighbouring farmers."

Glenbuck Blackfaces.

Mr Howatson of Glenbuck has been good enough to supply information regarding the management of his famous flock of Blackfaces.

Age of Draft Ewes.—Mr Howatson takes only four or five crops of lambs from his ewes before parting with them, as he finds that better and stronger lambs are bred from robust young ewes than from exhausted old ewes, and that, as a matter of course, five-year-old draft ewes sell better than ewes a year older. The draft ewes are sold early in October, and the whole remaining flock is then dipped, the dipping being repeated as weather permits to meet the wants of the Board of Agriculture's Regulations.

Early Lambs.—Mr Howatson lets his rams to the ewes in the second week of November, which is about a week earlier than the general custom. The best lot of rams go first, and then in about three weeks the remainder of the rams are put amongst the ewes so as to pick up those not already served.

Ram Lambs.—Mr Howatson has so much improved his flock that he finds a ready demand for his ram lambs for breeding purposes, so that few of them are castrated. He retains a few of the choicest of the ram lambs to bring out for shearlings, from which the best are again selected for home stud purposes, and the remainder, with the spare ewe lambs, are sold at sales in August, September, and October. The system of selling ram lambs, so successfully inaugurated by Mr Howatson about 1870, is growing in favour, as thereby the purchaser gets possession of the young sire which he can feed and treat as may seem best to suit his purposes.

Mr Howatson is opposed to the early clipping of rams for sale or breeding purposes.

Ewe Lambs.—The Glenbuck ewe lambs are weaned in August. The ewe lambs selected to be retained in the flock are dipped and sent back to the hill till the second week in October, when they are despatched to the low country, where they are wintered at a cost of from 8s. to 8s. 6d. per head.

Clipping.—Clipping begins in the second week of June with the ewe hoggs. At this time care is taken to mark for sale any of the ewe hoggs which may not in every respect be satisfactory for breeding purposes, special attention being given to the fleece, in the improvement of which Mr Howatson has been very successful. Mr Howatson thinks it advantageous to delay clipping ewes until the new wool is well raised, and the clipping of them is therefore postponed till the latter part of July.

BLACKFACE RAM-BREEDING.

The breeding of rams for sale to other flock-owners has become an important industry with many of the leading owners of the Blackface breed. With skilful and careful management the returns are usually substantial, the prices obtained for young rams of choice quality and character generally reaching high figures. For single shearling rams as much as from £150 to £200 has been realised at auction sales.

Information on the systems of management pursued in the breeding and rearing of Blackface rams has been kindly given by a number of owners of well-known flocks, including Mr Howatson of Glenbuck; Mr Archibald, Overshiels, Stow;

Messrs Cadzow Brothers, Borland and Stoneyhill, Carstairs; Mr Hamilton, Woolfords, Cobbinshaw; Mr Fraser, Rankinston, Ayr, and others.

Mating.—Special care is taken in the mating of ewes and rams so as to secure stock of the highest merit. The best ewes in the flock are naturally chosen for ram-breeding, but however good a ewe may be her lamb is not selected for stud purposes unless it is itself satisfactory in every way. In all judiciously managed flocks the breeding character of every strain is well known, and this knowledge assists greatly not only in the mating of ewes and rams, but also in the selecting of lambs, both male and female, to be retained for breeding purposes.

The few selected stud ewes are, as a rule, kept by themselves in fields where the pasture is good, and for the most part it is from these ewes that the successful show sheep are obtained. Still, in many cases the rams sold for stud purposes are bred from ewes that run with the general flock excepting at the time of tupping, when each tup is isolated with the ewes allotted to him.

The Overshiels System.

Feeding Young Rams.—Mr Archibald, Overshiels, writes: "The lambs to be kept as rams are weaned about the middle of August, when they are put on clover-foggage or cabbage, and taught as soon as possible to eat artificial food, such as linseed-cake. A good plan is to confine the lambs in a small enclosure where they can get nothing but cabbage, which they will eat greedily in a few days; then give them access to no cabbage except what are cut into troughs, and on the cut cabbage sprinkle linseed-cake and locust-meal. In a day or two the lambs will eat this food readily, and thereafter they will feed out of troughs and eat cabbages off the ground like older sheep.

"The ram lambs are put into the house not later than the first of October. There in some flocks they get a feed in the morning of a mixture of boiled barley and bran, with a pinch of salt. At mid-day and again at night they get a dry feed, consisting mostly of linseed-cake. Care must be taken not to give too much. At first ¾ lb. is ample, the quantity being gradually increased as the lambs get bigger, and it is found they can eat it with safety. Always have a rack filled with natural hay and a trough of fresh water within their reach. In course of time the lambs will come to eat over 2 lb. each per day of the concentrated food. In some cases a little cod-liver oil mixed with treacle is given in each boiled feed. Young rams intended for exhibition are by some considered the better of getting new milk twice a-day. Few of the animals can be got to drink the milk, so it has to be poured down their throats from a bottle. An ordinary cow will give enough milk for five or six shearling rams.

"After the grass comes, usually about the middle of May, the young rams should be put out a short time during each day, and put back to the house overnight and fed on green food, such as grass and tares, till the cabbages are ready. They should be well treated in this way up to the show or sale.

"The young rams should be clipped along the bellies and half-way up the ribs as early as possible in November, and the rest of the body should be clipped in December.

"The wool often gets so long that the animal is apt to pull it out of its breast by its feet and knees when rising; to avert this some tie the wool with tape in tassels about the thickness of four fingers. It is also a good plan to sew a sheet along the back to prevent the sheep from rubbing and spoiling the fleece.

"Rams that are out-wintered get the same treatment as the ordinary hogs. These out-wintered rams should be clipped if possible about the beginning of April, and if the farm is high and exposed they require to be housed for about six weeks, or until the weather gets favourable."

There has from time to time been much discussion over the question of the high feeding of rams. In theory high feeding is almost universally condemned, yet it is the practice of flock-owners to give the preference to highly fed rams in the sale-ring.

Messrs Cadzow's System.

Messrs Cadzow Brothers write: "In entering upon the breeding of rams, we

in the first place made up our minds as to the ideal type to produce for all practical purposes, and have kept that ideal before us all the time without the slightest deviation. Our ideal is a sheep wide in the back and ribs, walking freely and straight on not long but strong well-planted legs, and carrying a thick coat of wool, not hair. Our system of breeding is to mate our females with sires of a masculine type embracing all the characteristics of our ideal, strictly avoiding in-breeding, and purchasing fresh blood whenever we see suitable animals for sale, more especially when we can get animals which may excel in those points which need correcting in our own flock. In mating, we at all times see that the males are strong in the points in which the females may be lacking.

"The lambs are dropped from the middle of April till the middle of May. The ewes get nothing but pasture during summer, the lambs being weaned about the middle of August.

"The ram lambs when weaned are put on hay and stubble or foggage till about the middle of October. They are then housed. Their winter food consists of from an eighth of a pound to half a pound of boiled barley mixed with good bran, and from an eighth to a pound of a mixture of linseed-cake, Indian corn, and oats once a-day, with as much meadow-hay as they can eat, and plenty of good water. For showing we clip a few of the rams in January, but most of them are clipped in February and March. They are put to grass in spring, and get from half a pound to one and a half pounds of the raw mixed feed till the time of the sales in September."

The Woolfords System.

Mr Hamilton, Woolfords, writes:—

"Before the ram sales, in fact all the year round, I try to find out the weakest points in the breeding ewes, and if possible keep and buy rams strong in these points. At about the 15th November the ewes are all hand drawn to the rams, and each lot put into different fields for about 34 days.

"The ewes here have to be carefully drawn, with regard to pedigree as well as points, as there are always some home-bred rams used, and they have half-sisters and other near relatives in the stock. I have never gone in for close breeding, but I like a little of the same blood when practicable; of course when a ewe has done well with a sire one year she is put back to the same ram again.

"Each ram's lot of ewes are keeled differently, and when dropped in the spring the lambs are ear-marked with a different mark for each individual sire. Thus the sire of each ram and ewe on the farm is known.

"The ewes during winter are all kept on the hill pasture, and get nothing extra in the way of feeding except in time of heavy snow, when they get hay, on which they do very well. It never pays to let them get lean, as with the lot of twins here the loss in lambs and ewes would be great.

"When the twin lambs are able to walk they are driven down into fields, but do not get any extra feeding until weaned, unless when they are on very old grass; in that case the mothers get a little hand feeding during April and May. The single lambs get no extra feeding until weaned. If the forcing is commenced before weaning the lambs are apt to get coarse, and it is not good for the stock ewes.

"In the first place, as to the lambs that are to be sold as ram lambs at the ram sales in September and October, when weaned generally in the first week of August, they are put on to the best foggage on the farm, and get in addition lamb food and cabbages, as much as they will eat until sold.

"The ram lambs that are to be wintered and sold next year as shearlings are weaned at the same time and put on to clean grass, sometimes foggage has to be taken from home, the one object being to keep them growing steadily. They are put into the house about the middle of October, and are commenced with a little boiled barley mixed with bran, treacle, and salt for one feed, and lamb food or other mixed grains for the other meal. In about a fortnight they are getting ⅜ of a lb. of barley in a boiled condition, and ⅜ of a lb. of lamb food, this feeding being gradually increased until they get up to exactly double the quantity by the month of March.

"The rams are clipped in January or beginning of February, and are put out whenever there is grass for them in April. They are kept thriving steadily until the beginning of August, when they are put on to cabbage and as much corn as they will eat, to give them a flush for the sales. The important thing is to keep them steadily thriving from the day they are born until sold, with an extra flush in the last six weeks."

Mr M. P. Fraser's System.

Mr Fraser, Rankinston, Ayr, writes:—

"The ram lambs are weaned in the beginning of August, and put into foggage fields on the farm, where they are taught to take a feed of oats, Indian corn, and cake. About the middle of October they are put into houses (15 to each house or division), and in a few days they will have taken kindly to their winter rations.

It is very advisable at this time to carefully examine the sheep and see that they are free from foot-rot, because when once they commence to thrive, any backset from the above cause, or from an overdose of feeding, may lead to a malformed turn of the horns. The lambs are fed at 6 A.M. on oats, Indian corn, and cake; at 1 P.M. on boiled barley and Indian corn, with oil-cake and beans; and at 7.30 P.M. on oats, Indian corn, and cake. They receive a fresh supply of hay twice each day, and water is always before them. The amount of feeding is gradually increased till by December each lamb will be eating 1 lb. of raw food and ½ lb. boiled food per day.

"With the exception of a few show rams that are clipped in the middle of December, all are clipped after the New Year, and their feeding is altered to a boiled feed night and morning and a raw feed in the middle of the day.

"About the beginning of May the shearlings are gradually accustomed to the grass, the boiled feed is stopped and the raw feed increased, till by June they will be eating 2 lb. of oats, Indian corn, and cake. There is not the same danger of giving them an over-feed on the grass as there was in the house. Towards the end of July the cabbages will be ready and may be given freely to the shearlings. From now to the September sales it is just a steady plodding on upon these lines. With this feeding I have practically no losses from deaths between weaning and selling."

In Plate 54 portraits are given of a group of rams bred by Mr Howatson of Glenbuck, the group being arranged to represent the development effected in the type of Blackface rams between the years 1869 and 1894.

Portraits of a Blackface ram and ewe are produced in Plate 55.

CHEVIOT SHEEP.

What the Blackface is to the heathery hills of Scotland and the extreme northern districts of England, the Cheviot is to the grassy hills and uplands of the same range of country. The Cheviot at one time, indeed, was a serious rival to even the Blackface on what are known as the black hill sheep-runs.

In the early 'twenties of last century, and perhaps a little earlier, when the finer wools were rising in value, many heather-clad hill farms in Dumfriesshire and Ayrshire, and even as far north as Perthshire, Argyllshire, and Invernessshire, were denuded of their Blackfaces to make way for Cheviots. But some years after this a number of very severe winters were experienced, and the newcomers were not found to stand the stress so well as the Blackfaces did, and, indeed, many were killed out. There was, accordingly, a reversion on most of these farms to the original stock, and since then Cheviots have for the most part been confined to the Cheviot range on both sides of the Border, to Dumfries, Selkirk, and Roxburgh shires close by, and to the more luxuriant of the grassy slopes of Inverness, Ross, Sutherland, and Caithness shires in the far north.

Origin.

There is little doubt that Cheviots are natives of the Cheviot range, still to a large extent the headquarters of the breed. How long the breed has occupied these towering grassy heights it is impossible to say; but it was there, and apparently flourishing, when, in the interests of the British Wool Society,

Sir John Sinclair visited the locality in 1791. Not only did Sir John report very favourably upon the breed from a wool-growing point of view, but he was so much impressed with the merits of the sheep that he introduced them into his own county of Caithness, where they have ever since remained. After a time they also got a firm hold in the neighbouring county of Sutherland, which they have likewise succeeded in retaining. Indeed Caithness and Sutherland shire Cheviots have long enjoyed quite a fame of their own. No doubt, owing to the deeper and heavier land on which they are kept, they grow larger than the South-country Cheviots, and on this account are very popular for feeding purposes, especially on turnips. Caithness or Sutherland Cheviot wedders nearly always realise a shilling or two more per head than South-country bred Cheviots of the same class bring.

But, on the other hand, there seems to be something in either the soil or the climate of the south-east country which produces a finer type of bone and wool than the north does. As a consequence, nearly all the most noted flocks of the breed are in the south, and even the north country breeders have to come there from time to time for fresh supplies of rams to maintain their stocks.

Early Improvement.

In the early improvement of the Cheviot breed Lincoln blood seems to have been used in smaller or greater quantity. One specific statement is that "Mr John Edminstoun, late of Mindrum, Mr James Robson, then at Philhope, and Mr Charles Kerr, then at Ricaltoun, went to Lincolnshire about the year 1756, and bought fourteen rams with which they crossed their sheep with great success."[1] Substantially the same statement is made in the *Farmers' Magazine*, published some considerable number of years before. There it is stated that these Lincoln tups so improved Mr Robson's stock as to give his sheep a decided superiority over those of his neighbours, and for many years after making this cross "he sold more tups than one-half of the hill farmers put together."

All this happened a good many years prior to Sir John Sinclair's visit to the Borders. The introduction of the Lincoln blood would, no doubt, have had an important effect in improving the quality of the wool remarked upon by Sir John Sinclair, but of what other advantage it could have been to such a sheep as the Cheviot—much smaller as a rule than the Lincoln—it is not easy to see.

It has also been stated that Cheviots were crossed with the Border-Leicester type of the Dishley Leicester shortly after this breed was introduced into the Border districts from Leicestershire, but of that infusion such definite records do not seem to exist. Still, one can readily imagine that a dash of the improved Leicester blood would have been advantageous to the Cheviots of that period, when in many cases sheep of the breed were lacking in symmetry, and were inclined to be brownish in hair in parts and not nearly so white generally as at the present time.

Characteristics.

The Cheviot sheep as it exists to-day is one of the most handsome and vigorous-looking animals of the whole ovine race. Entirely white in appearance, it is very active on its legs, carries itself with great dignity and courage, and when put into a tight corner will make a bold dash for liberty even against considerable odds.

Appearance of Rams.—According to the first volume of the breed Flock-Book, which was published in 1893, the Cheviot tup should weigh alive at maturity when fat 200 lb. His head should be of medium length, broad between the eyes, and well covered with short fine hair. His ears should be nicely rounded and not too long; they should be well up from the eye and rise erect from the head. Low-set or drooping ears are a decided fault. At the same time, they should not be what are called "hare-lugged"—that is, too near to each other. This indicates a narrow face, which generally denotes a narrow body. The neck should be short and strong, and in the ram well arched. The nose should be arched and broad, and the nostrils black,

[1] Douglas's *Survey of Roxburghshire*, published in 1876.

full, and open, and the ribs well sprung and carried well back towards the hook bones. Though occasionally a ram will appear that has rudimentary horns, the breed on both the male and female side is a hornless one.

A long weak back is about the worst fault a Cheviot can have. The back should be broad and well covered with mutton, the hind quarters full, straight, and square, and the tail well hung and nicely fringed with wool. The legs must stand squarely from the body; bent hocks, either out or in (the latter especially), are looked upon as a weakness. The bone should be broad and flat, and must be covered with short, hard, white hair. The wool should meet the hair at the ears and cheeks in a decided ruffle. Bareness there or at the throat is inadmissible, and the wool should grow nicely down to the hocks and knees. The belly and breast ought also to be well covered.

Appearance of Ewes.—The same description suitably modified will also apply to ewes, which usually weigh alive from 100 to 150 lb.

Wool.—The fleece of the Cheviot ram should weigh about 10 to 12 lb., of the ewes about 4½ lb., and of the wethers about 5 lb. Although the Cheviot is an excellent mutton sheep, its outstanding feature is the high quality of its wool. Cheviot wool is of a close, dense, beautifully fibred type, and has always been in great demand for the production of the best class of tweeds. Indeed, it was Cheviot wool very largely that made the name and fame of the Hawick, Galashiels, and other Border district tweed manufactures.

Crossing Purposes.—In addition to its other merits the Cheviot is of great value for crossing with the Border Leicester. Cheviot ewes put to Border Leicester rams give the popular half-bred—one of the most valuable commercial sheep that is to be found in Scotland. Half-breds are extensively used on arable farms all over the south of Scotland, and they make not only excellent grazing sheep but first-class stock for fattening on roots. It has been stated that half-breds pay more rent in the arable parts of the south of Scotland than any other breed or class of sheep, and the claim is believed to be well founded. They are also most extensively used in Northumberland, and are found as far north as Aberdeen. From the half-bred, again, by the use also of a Border Leicester ram, is bred the very plump three-parts-bred—one of the quickest maturing of the sheep tribe, and greatly run upon for feeding rapidly off foggage or turnips.

Improvers of Cheviots.

One of the first and most noteworthy improvers of Cheviot sheep in comparatively modern times was Mr James Brydon of Moodlaw and Kennelhead, in the county of Dumfries, who held biennial sales of rams at Beattock from 1851 to 1881. Mr Brydon favoured what was known at the time as the west-country type of Cheviot—that was, a sheep with more length and substance than the original east-Border kind, but neither so stylish nor so dense in the character of its wool. It has been said that Mr Brydon introduced Border Leicester blood, and that he got the extra length in this way; but however this may be, his sheep had a great run of success for many years, both in the showyard and at his biennial sales. At the latter he was accustomed to average from £15 to £17 per head for from 150 to 180 rams—figures which could hardly be excelled even at the present day.

Individual prices were much higher. In 1867 Mr John Miller of Scrabster, Caithness, gave no less than 185 guineas for one specially good ram, "Craigphadrig" by name. This, it is noteworthy, was the record price in Scotland for rams of any breed for several years; indeed it was not exceeded until 1873, when Messrs Clark gave £195 for one of Lord Polwarth's Border Leicester rams from Mertoun. Successful as they were for many years, Mr Brydon's sheep latterly gave way to softness, and to a considerable extent lost their pre-eminent position.

For this result some people blamed the introduction of Border Leicester blood, while others alleged that the softness was due to the winter house-feeding of rams which was introduced in Mr Brydon's day. While both may have been predisposing causes, some part of the trouble may also have been due to the fact that attempts to raise mountain

breeds of stock above their natural size have practically always ended in failure.

At any rate, where Mr Brydon met with failure, success was attained by Mr Thomas Elliot, Hindhope, Jedburgh, who had been working almost contemporaneously with the east-country and smaller type of sheep. Mr Elliot took the place which was gradually vacated by Mr Brydon, and his type of sheep as represented by the Hindhope flock—which is now carried on with great success by his son, Mr John Elliot—is still the dominant type of the breed.

Flock-Book.

In 1891 the Cheviot Sheep Society was formed and flock-books with a register of rams have been published annually since 1893. The secretary is Mr John Robson, Newton, Bellingham, Northumberland, himself a noted breeder of Cheviot sheep.

MANAGEMENT IN CHEVIOT FLOCKS.

The management of Cheviot flocks is comparatively simple. Except in the case of rams intended for sale for breeding purposes, little housing or special feeding is resorted to.

Newton and other Flocks.

Mr John Robson, Newton, Bellingham, whose valuable and old-established flock of Cheviots has for several years taken a leading position in the showyards, has favoured us with some notes relating to the management of his own and other similar flocks. His flock is entirely home bred. He casts ewes 6 years old. West of the Carter Fell ewes are sold at 6 years old, north of it generally at 5.

Selling Young.—Wether lambs used to be hogged on the farm, and kept till 3 or 4 years old, then sold fat—or in plentiful turnip years, for turniping. Now, on account of bad seasons, increase of sickness, and low price of wool, they are mostly sold as lambs, to go to better land to be fed off as shearlings; or if kept on hill farms, they are sold at 2 years old.

Weights.—Ewes weigh when sold probably 60 lb., wethers, 72 lb.; but, of course, when very fat they greatly exceed these weights.

Hirsels.—On the Cheviot Hills a farm is generally divided into two hirsels. On large farms the number of hirsels is of course multiplied indefinitely. But take a sixty-score farm—the ewe hirsel will contain three ages of twelve scores of ewes each, 3, 4, and 5 years old; the hogg hirsels, two ages of about twelve scores each of 1- and 2-year-old sheep. At clipping time the 2-year-old ewes or "young ewes" are brought from their "hogging" and put amongst the ewes, their ground being hained till the end of July, when the ewe lambs are weaned and taken to it.

Land "tired of Hogging."—Thus lambs never follow lambs, the ground always getting a year's rest from lambs, as they are allowed to remain till 2 years old. If lambs follow lambs too often, the land is apt to get "tired of hogging," which, if continued, means that the hoggs either die freely of sickness or of poverty.

Age for Breeding.—When farms are managed on this system, the gimmers are not, except on the very best low-lying farms, expected to bring lambs; only a few of the strongest are put to the tup.

West-country System.—The other or West-country system is to allow the ewe lambs to follow their mothers—none but those on the draft ewes being weaned, and those only for ten days, when they are put back to their mothers. Here the gimmers in good seasons are expected to bring lambs; all but a few of the worst get the chance of the tup, and the ewes are generally sold at 6 years old.

On land addicted to louping-ill this is much the best way, as there is less change; but on the healthy and stormy Cheviot Hills the former plan has this advantage, that it provides a stock for the harder and higher ground which would not keep ewes, and also allows of the hoggs being better looked after in a storm.

Feeding in a Snowstorm.—The only difference between winter feeding and summer is, that if a snowstorm comes which blocks up the ground so thoroughly that little or no natural food can be got, the sheep are given hay. About 1 lb. each is the usual quantity once a-day, as early in the morning as possible. Great care should be taken to keep sheep in as small "cuts" as possible — 100 is about the best number,

and every farm should have a stell for every cut of sheep.

Hand-feed judiciously.—Hay should only be given to prevent hunger, as on some land sheep which have been heavily hayed do not thrive next summer so satisfactorily as those which have not been so much pampered. Corn or cake has also the same tendency, and ewes which have been hand-fed one winter always look for the same indulgence afterwards.

Wethers on Turnips.—Wethers are mostly kept on turnips about 20 weeks the first winter, and 6 or 8 weeks the next.

Extra Food with Turnips.—As a rule, no additional food is given to sheep on turnips, but sometimes when turnips are taken by the week sheep get hay or straw; feeding-stuffs are rarely given. If a hill-farmer has turnips of his own, he is generally a generous feeder, giving cake or corn and hay to fattening sheep, and hay or straw to hoggs. In a storm all sheep get hay, but seldom corn or cake.

Rams.—The rams are usually kept amongst the other sheep during summer. In winter they get turnips, and when being prepared for sale a little cotton-cake.

Price and Quantity of Turnips.—Turnips for wethers cost about 5d. or 6d. per week; for hoggs, 3d. And as an acre of fair turnips is said to winter a score of hoggs, it may be supposed that the same quantity will keep 20 wethers ten weeks. Probably an acre and a half will be required to feed 20 wethers.

There is now a greater tendency to treat Cheviots as park sheep than there was prior to 1890. Owing to so much of the worn land being now stocked with blackfaces it is possible to give Cheviot ewes more indulgence in the spring than they used to get, seeing that they have good land to return to. This change in management probably accounts for the greater demand for larger sheep than was the case formerly. And this was also helped by a cycle of good seasons which Border farmers have experienced after the disastrous 'eighties. Now practically all the wedder lambs are sold to feeders, none being left for breeding farms. A few wedder flocks are still left in Sutherland, and some shearling wedders are fed off in parks on turnips, but none are now left on the hill pastures of the Borders.

Mowhaugh Flock.

In Mr J. R. C. Smith's flock at Mowhaugh, Yetholm, lambing begins usually about the 20th of April and extends on until about the end of May. Ewe lambs are weaned about the 20th of July, and wedder lambs from the 12th of August onwards. After being weaned ewe lambs get three weeks' change to a freestone country, and then go on to their winter hirsel. They do not, however, follow their dams. Cheviot lambs sold in August realise from 14s. to 20s. apiece. In the spring the same lambs should weigh from 48 to 56 lb., and be worth from 36s. to 45s.

Cheviot ewes in the flock depend almost entirely on their hill grazing, getting hay in very stormy weather. Ewes of this breed bring their first lambs, as a rule, at 3 years old, and are drafted out at from 5½ to 6½ years old.

Rams are sold at 2 years old, and are lightly fed the first year, getting a limited allowance of turnips but plenty of hay and ¼ lb. box-feeding per day. In the second winter they require better feeding in preparation for the sale-ring.

Alton Flock.

Lambing in Mr Michael Johnstone's flock at Alton, Moffat, begins on 18th April, and weaning takes place about the beginning of August. When running with their mothers the lambs may get a chance of a little oats or Indian corn, but they get nothing but grass after weaning. All lambs are sold at Lockerbie Auction Mart. In 1908 top wedder lambs realised 15s. 3d., and mid ewe lambs 15s. 6d. Ewes on the hill get nothing but what they gather. Any lean ones are brought in to the fields. Ewes to be mated with Border Leicester rams are kept in the fields, and get turnips, oats, and hay, beginning in the month of February.

Ewes drop their first lamb at 2 years old and are cast at 6. Young rams are run on "seeds" after being weaned, and are wintered on cut turnips and corn. Stock rams are summered on the hills;

in winter they are brought down to a field, and get hay and cut turnips.

Mr Johnstone brings his Cheviot ewes from the hill when they are 6 years old. They are run in the fields all winter, and a half-bred lamb taken off them. The following summer they are sold in the market, generally to go to Ireland. Half-bred lambs bred in this way usually begin to arrive about the 26th of March. These lambs are also sold at Lockerbie, realising for the best, in 1908, 25s. Ewes, after nursing half-bred lambs, fetch up to 23s. apiece.

Dalchork, Lairg.

A good example of the management of Cheviot flocks in the North is afforded by the system which prevails in Messrs W. and C. Mundell's flock at Dalchork, Lairg, Sutherlandshire. Here the lambs arrive from the 20th of April until the 28th of May. They are weaned about the 8th of August. No extra food is given to the lambs before weaning, but after weaning the wedder lambs are sold, and they usually get extra food almost as soon as they arrive at their destinations. No extra food is given to the ewe lambs until October, when they go to Ross-shire to wintering, and the worst of them get turnips in the spring.

Lambs in this flock, like those in most other flocks in the North, are sold at the Inverness wool market and are delivered about the 8th of August. The price realised in 1908 was about £1 per head for the tops. "Shott" lambs are put on to foggage after being weaned, and are sold about a month later at Inverness. In 1908 they realised 16s. per head. Ewes are disposed of at Lairg sale in the end of September, averaging in 1908 32s. 6d. Shearling tups are sold at Dingwall, the average price in 1908 being £7.

The ewes of the flock receive no artificial feeding of any kind except about sixty of the worst, which get, for about a month before lambing and until the grass comes on the hill, about 1 lb. of whole oats and bran and the run of a good park.

In very bad winters all the ewes get hay, but only when they cannot have sufficient natural food. Ewes bring their first lamb at 2 years old, and are cast at 5 years old.

Tup lambs after being weaned are sent to a farm in Ross-shire, and remain there until the end of April. They are grass wintered up to the 1st of January, when they are put on to turnips for about a month. After that they get cut Swedish turnips and good hay.

Stock rams are sent to Ross-shire also when they come from the ewes, and are put on to turnips and get good clover hay.

In addition to the other classes mentioned, Messrs Mundell sell every year about two hundred gimmers (shearling ewes), those disposed of in 1908 making 40s. to 55s. per head. These gimmers are a little more liberally fed than the gimmers that are kept for stock purposes.

A Cheviot ram is represented in Plate 56.

THE EXMOOR HORN SHEEP.

Sir T. D. Acland, writing in the *Journal of the Royal Agricultural Society* in 1850, describes the horned flocks which run on the Somersetshire hills. He mentions that the ordinary sheep of the country when fat do not weigh above 10 or 11 lb. per quarter. "Where pains have been taken to improve a flock, they may reach on the average 16 to 18 lb. per quarter, and some are brought up to 24 lb. per quarter, fed on Bridgewater marshes."

The Exmoor Horn sheep is stated by some authorities to have a common origin with the Dorset Horn—a belief which may not be far wide of the mark, seeing that there is a similarity in appearance.

Characteristics.

A fine open curly horn decorates a white head of pleasing appearance.

The fleece is close, and the wool comes right up to the cheeks. The appearance of the breed is not unlike the Cheviot in formation of top, loin, and quarters. The wool is of medium length, superior in quality, and the fleece is so dense as to defy the storms which so frequently cover them over in winter for days at a time.

The ewes are prolific, producing from 30 to 50 per cent of doubles. Record is made of one ewe, owned by Mr Tom Elworthy of Simonsbath, which had 25

lambs, having reared 24, and was then nursing twins.

As indicative of the hardy character of the breed, a writer chronicles that lambs reared on the Wiltshire Downs from Exmoor ewes at three months old, without artificial feeding, realised 38s., the land being so poor in quality that its rent was only 1s. per acre. Breeders aim to produce a wether which at sixteen to eighteen months old will give a carcase, matured at small cost, of from 16 to 18 lb. per quarter. Such sheep, carried on for Christmas, would kill 30 lb. a quarter.

MANAGEMENT.

The management of Exmoor flocks, as a rule, is of the simplest. The ordinary grazing is at times supplemented with artificial food. In the best flocks green food is specially grown to keep the young sheep thriving. In the flock of Mr D. J. Tapp of Highercombe, Dulverton, weaning takes place about the middle of June—the lambs being turned on to the best grasses, pasture and clover. Water is available. If any appear to pine or do not thrive well, they are removed to vetches and mustard, which are grown expressly for the purpose. This is continued till they go on roots, when they get a little hay, and the wethers a little cake and oats. They are grazed the following summer on rape. When fat, they vary from 60 to 72 lb. per carcase.

After weaning, the ewes are drafted—the drafts being kept on poor enclosed land till they are sold in August. The breeding ewes are turned out on poor common land, where they stay till about the middle of September, when the rams are put to them. They have to subsist on grass up to Christmas, when the yearling ewes and weaker ones have hay and a few roots carted to them. The stronger ewes come after the hoggs on roots, and get a run on grass till the middle of February, when the lambing ewes are selected to get a few mangels and go on the best pasture. At that time there is usually plenty of rough grass.

After lambing, the ewes with single lambs are put on the worst meadows, and a few oats and perhaps cake are given. This is continued till May, when they go on to clover.

The number of lambs reared is about four lambs to every three ewes. If the season is fine, there is a larger crop—the number depending to a considerable extent on the weather. This can be understood when the altitude at which they are reared is remembered.

An Exmoor ram is represented in Plate 60.

THE DARTMOOR SHEEP.

This picturesque breed of sheep is named after the fine open tract of country in Devon and Somerset in which it is reared. It is one of the old local breeds of England, dating far back. In late years the hand of the improver can be traced. Like all breeds which have the open moorland or the hill for their home, it thrives amazingly on wild herbage.

Characteristics.

Description.—No doubt the Lincoln and the Leicester have been used to get substance as well as strength and weight of fleece. The old hardy character of the breed, however, is still maintained. To live on the bare expanse of Dartmoor a sheep of great constitution is necessary, and this the native breed possesses. When the additional fact is mentioned that the rainfall is excessive, averaging over 60 inches in the year, the importance of having a breed of sheep sound in hoof and liver will become apparent.

In size the Dartmoor of to-day is different from the little Moor-dag of olden times. The fact that in the best flocks a fleece of close on 14 lb. (in the grease) is clipped, implies a sheep of some substance and stature. The fleece is thick, strong, glossy, and curly, growing long, after the moorland type. It is the custom to shear the lambs.

Appearance.—In form, symmetry is much looked for, and lean flesh has not been bartered for fat. Good sheep should carry themselves well, and gaiety of carriage comes from good vertebræ and a strong neck. The head is bold, the face broad and somewhat coloured, the eyes full and bright, and the nostrils

black (in the ram prominent). The ears should be thick and well covered with clean smooth hair. A small horn is not objected to, as it is supposed to indicate strong constitution.

As kept on the moorlands the Dartmoor was a whitefaced sheep, horned, and somewhat coarse in the fleece. The wethers were kept on the moor all the year round, and in the olden times were expected to yield a profit out of their wool. They were then hand-feeders.

The other type of Dartmoor, the greyface, mottled with black spots on a grey face, the legs being similarly marked, is found only on the moor during summer. They are very ready fatteners, and respond well to a cross for fat lamb.

Lambs and Wethers.—The ewes are good mothers, giving abundance of milk even on inferior pasturage. The ram is usually put to the ewes towards the end of September. The Down cross is frequently resorted to for the production of lambs suitable for fattening, the South Devon ram also being used for this purpose. The wethers are usually fed from one to three years old, and at the latter age they come to from 80 to 100 lb., the weights respectively representing the old-fashioned whiteface and the modern greyface. The ewes are prolific. Mr J. R. T. Kingwell of Great Aish, S. Brent, records a crop of 166 lambs from 112 ewes.

Clip.—Good fleeces are borne by the Dartmoor. Ewes in good condition will clip from 10 to 11 lb. each, and wethers from 12 to 14 lb.; rams sometimes up to 30 lb. It is recorded that Mr F. Ward of Burnville, Tavistock, once clipped 33 lb. of wool from a ram—the wool, of course, being in the yolk.

MANAGEMENT.

Dartmoors are generally fed on grass and turnips, to which a little corn or cake is added as the sheep draw near marketing. The wethers are advantageously used to graze bullock pastures in the autumn and winter months in Somerset and elsewhere. The change is highly beneficial, as they grow very rapidly. They also resist fluke better on those pastures than most breeds.

The moorland sheep have never a very rich pasture. For the most part they find their own living, but when hard pressed in winter are supplied with hay made from coarse moor herbage. Occasionally they may have a few turnips, but the heavy rainfall and wet soil often prevent the carriage of roots when most wanted.

Chief Markets.—Amongst the chief markets are Tavistock, Brent, Plympton, Okehampton, and Mortonhampstead.

A portrait of a Dartmoor ram is given in Plate 60.

THE LONK SHEEP.

The Lonk is a breed of sheep of a type peculiar to itself. It is found in Yorkshire, Lancashire, and Cumberland. It is a hill-breed with a fine presence, particularly when arrayed in full fleece.

Origin of the Name.—The derivation of the name Lonk is somewhat obscure. Probably it is an obsolete provincial term. According to *Holloway's Dictionary of Provincialisms* (1839) Lonk means Lancashire sheep. From another source we derive the information that Lonk means a Lancashire man, also a Lancashire sheep. In Lowland Scotch Lonker means a hole in the dyke through which sheep pass. Then, again, Lonk is another word for lank or leggy.

Locality.—The Lonk exists at a great altitude. It lives on poor land which is valuable mainly for shooting. The main force of the breed is found in the hill districts of Lancashire and the West Riding of Yorkshire—on Longridge Fells, Clitheroe, Whiterwell, Pendle Hill, Craven, and other districts, besides on the hills of the county Palatine.

The breed is chiefly in the hands of small farmers, and is largely used for crossing purposes, chiefly with the Scotch Blackface sheep, resulting in a heavier weight of mutton and a better class of wool.

Weight.—The usual age at which Lonk sheep are fattened for the butcher is three years. A good four-year-old would average about 65 lb., and a top weight probably 80 lb.

They are a very hardy breed, and have some affinity with the Scotch Blackface sheep.

Characteristics.

Seen in full fleece, the Lonk sheep has a very commanding appearance. Breeders look for size. The body is long, thick, and deep. The tail must be long for protection, stout, and straight. The colour of the legs and face is clear black and white streaked, making a dark face. The legs should not be as black as the head. The horns should be waxy in colour, strong and curled, very much like those of the Scotch Blackface mountain breed. They should be equally set in the head, not too close.

The head should be large, a good strong face being a point aimed at. The nose should be thick, deep, and heavy, the eyes full and large, and the ears long. On the forehead a tuft of wool is cultivated. The legs should be thick and full of bone, although a trifle "shanky." They should be wide set, and rather short from the knee to the pastern. The hoof should be sound. The chest must be wide and deep, the back long and rather narrow at the lumbar region. A thick, full fleece is cultivated with a long staple. The fleece should be carried down to the knee and hock, and should be free from kempiness.

Clip.—In a Lonk flock the average clip is from 9 to 10 lb., although a shearling will sometimes produce as much as 17 lb.

MANAGEMENT.

The management of a Lonk flock may be said to pursue an even course. There is a great similarity in the methods adopted in all hill breeds. The average Lonk flock will drop from 1⅓ to, in the case of the smaller flocks, 2 lambs per ewe. For instance, in the flock of Mr David Hague of Copynook, Bolton by Bowland, in the year 1908, 79 lambs were born from a total of 40 ewes.

The ewes are turned to the ram about the end of September, lambing in March and April. They winter on grass, except in very rough weather, when they have the assistance of hay. The practice of giving roots before lambing is not favoured, but after they have lambed a little corn-and-root ration is an advantage.

Towards the end of April the show stock are separated from the others, which are turned out to pasture. The ram and ewe lambs intended for show are housed in October and fed on cake, corn, and roots.

Mr Hague sells his draft ewes at home. The ram lambs go into the Fells to cross with the Scotch Blackface ewes. The draft ewes are sold to farmers, who cross them with other breeds, of which the Wensleydale is as popular as any. The half-bred sheep-raising business engages much attention in the north of England, and the size, substance, and springy coat of the Lonk are favoured, as they give the progeny a fine bulky appearance.

A Lonk ram is represented in Plate 61.

HERDWICK SHEEP.

Probably the hardiest of all British breeds of sheep is the Herdwick, whose ancestral home is the cragland of Cumberland and Westmorland. These sheep lead a roving life, exposed often to very inclement weather, and living on what they can pick up on the mountain-tops even in winter. Like other breeds, it is reputed to be a descendant of a number of sheep which came ashore from Spain's Grand Armada. Be that as it may, it is a useful breed, living where others would starve. It is said to be a cherished tradition with the best breeders that sheep of the breed refuse even hay in winter.

The flocks are usually taken over from the landlords at valuation, succeeding tenants keeping the same blood.

Characteristics.

In appearance the breed is small, the head is light in colour, open horns springing from the base of the skull. The fleece is very strong.

The breed has a reputation for the quality of mutton, which has that epicurean flavour associated with mutton raised on the lean fare of the mountains.

One peculiarity of the breed is that the lambs are born with black heads and shanks, the ears, however, being tipped with white. The colour gradually lightens,

until as three-year-olds they are either white or hoary in appearance.

In the words of Mr James Bowstead, a Herdwick sheep should have "a heavy fleece of fairly fine wool, disposed to be hairy on the top of the shoulder and growing down to the knees and hocks; poll and belly well covered; a broad, bushy tail, and a well defined topping; head broad; nose arched or Roman; nostrils and mouth wide; teeth broad and short; jaws deep, showing strength of constitution and determination; eye prominent and lively, and in the male defiant; ears white, fine, erect, and always moving, as has been said, 'like a butterfly's wing.' There should be no spots or speckles, nor any token of brown on the face, as these are considered sure tokens of a cross. Horns in the ram are desirable but not essential. They should rise out well at the back of the head, be smooth and well curled. White hoofs are much preferred. The females are polled."

MANAGEMENT.

The breed is unique in its "late" maturity. At four and a half to five years old they are ready for the butcher, and when fattened on the mountains they kill from 10 to 12 lb. per quarter. They do not take kindly to rich food. The ewes are put to the ram when from two and a half to three years old.

May is the usual lambing time, and the time for mating the ewes is regulated to suit the lambing period. The tups are in some parts turned to the ewes on the Fells in order that lambs may fall early in May. The gimmer shearlings are bratted, or "clouted" as it is called—*i.e.*, a piece of cloth is tied over their tails to keep them from service. When the ewes are kept on bare fare the percentage of twins is negligible, but on slightly better pasture the doubles may be reckoned up to 20 per cent.

Mr James Todd of Rougholme remembers showing a number of draft ewes at Ambleside Fair, 13 of which were sold to a farmer in the Ulverston district. These 13 ewes dropped 27 lambs in the following spring.

The ewes are not drafted at any particular age, that process being determined as much by constitution as anything else. On the average, from 4 to 6 lambs will be taken from the ewes before being drafted. The ewes disposed of usually go for crossing.

The wethers are now usually sold off, either as lambs or one or two years old. At one time they were kept until full-mouthed or four times clipped. They are usually turnip-fed, and have been known to bring over 30s. direct from the Fells. The hoggs are put out to winter in October on better land than they occupy in summer, costing from 5s. to 6s. each till they are returned in April.

A Herdwick ram is represented in Plate 62.

WELSH SHEEP.

This breed is widely distributed throughout Wales. It is one of the oldest types in the country. It is, too, a well-defined type, although the efforts of improvers and the variation in the quality of pasture are liable to alter the old-fashioned Welsh sheep and present it in different sizes. Thus we find that the eastern slope of the Berwyn, Merioneth Hills, and Plynlimmon is decidedly superior to the western in pasturage, and the sheep grown thereon are larger and possess finer wool.

The mountainous portion of Wales is divided into sheep-walks, and flocks vary in size from 200 to 4000. Here the thorough acclimatisation of a flock is said to be worth to the owners from 5s. to 8s. per head over the market value.

Characteristics.

Type.—The Welsh Flock-Book Society has determined the type of sheep that it wishes to encourage. The head of the ram should be wedge-shaped and tapering towards the nose. A broad forehead, black muzzle, face slightly tanned or white; horns strong and well curved, but not too close at the roots; eyes prominent; ears small, thin, and obliquely set; scrag strong and thick; brisket prominent; back straight; loins strong; tail long, strong, and bushy; legs short, white, and slightly tanned; skin pink; wool short and thick; handling

firm; a small proportion of kemp permissible practically completes the qualities of the Welsh mountain sheep.

Infusion of Alien Blood.—Efforts have been made by the introduction of Cheviot, Dorset Horn, and Kerry Hill blood to breed a bigger sheep, but the results have not been wholly satisfactory, although in Breconshire the Cheviot cross is favourably spoken of. It is worthy of note that the Cheviot cross has made itself pronounced in succeeding generations in the character of the fleece and the shape and colour of the head. The influence of the Dorset Horn, too, is noticeable in a big collection of show sheep such as one witnesses at the Welsh National Show at Aberystwyth. The writer remembers a prize-winning ram which had almost every characteristic of a pure Cheviot, and yet had only a twelfth of Cheviot blood in him. Probably the most satisfactory results will be obtained by such a mild cross as the exchange of rams from different localities—such, for instance, as Cader Idris and Plynlimmon.

Dead-weight.—Welsh sheep have a deservedly high reputation in the London market. Wethers at from three to four years old kill from 9 to 11 lb., but greater weights are got on good pasture, although the hill breeder protests that the name of Welsh mutton must in the future be maintained by small sheep. A real typical Welsh leg of mutton should run to about 5 lb. in weight.

Wethers were at one time kept till four years old, but the lamb trade has developed much of late years. Wethers off the poorest pastures will kill when ripe up to 35 lb. October-sold sheep, caked and corned in spring and summer, weigh in carcase up to 45 lb., and exceptionally well-wintered sheep up to 55 lb.

Crossing Experiments. — Experiments in crossing have been conducted at several centres. At the University College of North Wales, Madryn Farm, Wiltshire and Southdown rams proved very successful. Contrasting the Wiltshire and Southdown cross, one dealer remarks that "the difference between the Wiltshire and the Southdown cross is that for Salford market and for overhead sale I prefer the Wiltshire, as they look bigger in the pens, but for selling and retailing in the shop on the coast Southdown crosses give most satisfaction."

In some experiments conducted by Mr D. D. Williams of the Aberystwyth College with Welsh ewes the average weight of the Shropshire cross lambs was 56 lb., the Kerry Hill crosses 68 lb., and the pure Welsh 46 lb. Taking the weight of lamb per ewe—*i.e.*, including twins—the Shropshire averaged 68 lb., the Kerries 96 lb., and the Welsh 61 lb.

MANAGEMENT.

The management of Welsh mountain flocks has not varied much for generations. The same strains of sheep have been kept on the different sheep-walks for many decades, the incoming tenant, as a rule, taking the flock over at valuation. During the severity of winter the flocks are removed from the uplands, those inhabiting the higher altitudes usually leaving their summer habitations from October till April.

It is the custom to sell the wethers at three or four years old, when they are either disposed of in their coats in June, or are, in the month of October, sold to be caked on roots. The change from the bare mountain fare to the rich lowland lands effects a wonderful transformation, and they fatten very rapidly. The tendency of the breed, however, is to grow naturally on the hillside, and forced feeding generally results in a somewhat fat carcase.

Latterly farmers have endeavoured to get their lambs fit for the market early, but obviously this must be accomplished on the lowlands, the youngsters being immediately after birth transferred to the more hospitable pastures. When failure to fatten early has resulted, it has been due to inability to appreciate the fact that the ordinary hill grazings are not the most suitable lands to push young stock forward. The most common practice is to run lambs on good pastures through winter and spring, enabling them to be fattened in the following summer or early autumn. They then command the top market price. In the poorer districts, and where the full severity of the climate is felt, instead of being fattened the young sheep are sold

in May or early June for grazing during the summer months.

Wool.—Welsh mountain ewes will clip from 1½ to 2½ lb., and rams up to 6 lb. On most Welsh sheep farms mutual help is provided at shearing time.

Plate 63 contains a group of Welsh shearling ewes.

KERRY HILL (WALES) SHEEP.

Many people have a confused notion that this breed hails from the Emerald Isle. It has nothing whatever to do with Co. Kerry, being named after the range of hills in Montgomeryshire. It has latterly come into prominence, as a result no doubt to the fact that many hill-sheep farmers have been revising their notions concerning the size and weight of mountain sheep. Greater weight is now being aimed at.

Characteristics.

The Kerry Hill breed is speckle-faced (black and white), not too dark. The head is broad at the base and tapering to the muzzle. Wool should cover the poll, and a tuft of wool should decorate the forehead. The cheeks should be clean, but the jaw-bones are covered with wool. The ears are short, thick, and speckled. The symmetry of the sheep should be preserved, the points aimed at being the production of a mutton sheep with broad back, full brisket, well-packed loin, and full thighs. The tail should be fleshy and well set on, the legs squarely planted, speckled, and free from wool below the knee. The skin should be pink, although a red skin is not objected to. A tinge of blue is, however, a bad fault.

Official Description.

The following is the official description of a Kerry Hill sheep :—

Head.—Fairly long, not too broad, tapering to nose, well covered with wool on top between ears, brown or black objectionable, with bunch or tuft of wool on forehead.

Face.—A good speckled face, black and white—the colours clearly defined and not mixed—the black not too dark, but inclined to dark grey; clean cheeks, well woolled to jawbone.

Eyes.—Prominent, bright, and bold looking.

Ears.—Fairly short, thick, well set, and speckled.

Scrag.—Strong and muscular, and well set into shoulders.

Throat.—Well woolled, free from loose or hanging skin, well sloped to brisket.

Brisket.—Should be very wide, deep, and well covered with wool.

Shoulders.—Blades wide and flat, blending with neck ; shoulders full of flesh down to arms.

Ribs.—Well sprung and deep, giving a straight underline from arm to thigh, with plenty of heart-girth.

Back.—Strong, level, with plenty of length from hip to tail.

Loins.—Wide and strong.

Hind Quarters.—Wide and deep, well covered with flesh to hocks.

Tail.—A long tail well set on fleshy, large dock, with plenty of wool to point.

Legs.—Four good short legs, set four-square, with large bone, speckled, and free from wool below the knees and hocks.

Under parts.—Well covered with wool.

Skin.—A nice pink or red skin free from black or blue spots—a blue-tinged skin is objectionable.

Wool.—A tight, close fleece of good length and pure white wool, showing a little fledge on face, coarser on breech and tail.

Size.—This should be kept within reasonable bounds—large sheep are apt to lose hardiness and activity and become less fitted for living on the hills ; smaller-sized sheep are more saleable.

MANAGEMENT.

In the drafting of ewes greater care is now exercised than was at one time common. When ewe lambs are numerous they are culled more rigorously. The stock ewes are generally brought down from the hills about September and the early part of October, mating taking place in the latter month, or earlier if early lamb is desired. The flocks are kept at an altitude of from 500 to 1500 feet in summer. When the majority of the ewes have been served, they are sent to the hills again with a ram in case any should return for second service. They are kept there as long as the weather permits. When too severe they are brought back to the lowlands and have hay given to them.

Hill breeders are not dissatisfied if, when the season has finished, they can count a lamb to the ewe. On the lower lands, however, there would be about a lamb and a half to the ewe.

Clip.—Shearing usually takes place in June. Ewes will clip from 5 to 7 lb., yearling wethers from 6 to 8 lb., rams from 10 to 14 lb., and lambs from 1 to 1½ lb.

Weights. — The wethers are chiefly fed off as shearlings, being sold from May to October. They will average about 14 lb. per quarter, though many will weigh from 16 to 20 lb. per quarter; and fat lambs will average from 10 to 12 lb. dead-weight.

The ewes are fine mothers, and if given cake and corn, are fit for the butcher simultaneously with the lambs.

The breed is very largely used for cross-breeding, and has a great future before it.

A Kerry Hill ram is represented in Plate 63.

DERBYSHIRE GRITSTONE SHEEP.

It may be taken for granted that these sheep, indigenous to the mountainous district which forms what is known as the "Peak of Derbyshire," are as old a breed as can be found in Great Britain. Documentary evidence to prove all this has not yet come to light, but traditions amongst the hills aver that from time immemorial these sheep have existed where they flourish now. The breed has been preserved in yeoman families whose antiquity rivals that of the sheep themselves, and preserved without intrusion of alien blood. The mountainous chain locally known as "Axe Edge" —the home of the Gritstone sheep— extends from Cheshire, through the Peak of Derbyshire, and away into Yorkshire; but the Peak is recognised as the central home of the breed.

Improvement. — "The Derbyshire Gritstone Sheep Breeders' Society," founded on October 15, 1905, and now an influential body, has set itself most commendably to the task of securing pedigree for the breed, as an addition to the local habitation and name of which these sheep have long been in possession. The distinguishing appellation, "Gritstone," is appropriately derived from the "millstone grit" which forms the geological basis of a large portion of the district to which the sheep belong. Similarly, in the southern portion of the Peak country, where carboniferous limestone prevails, the sheep—of the Leicester type—are locally and generically called "Limestone" sheep.

The secretary of the Society, Mr W. J. Clark, says that in some localities a considerable amount of alien blood has been introduced, "and still the Gritstone character of such crosses strongly predominates"; and he aptly adds that "the sheep have been for many generations bred pure, or otherwise their characteristics would have almost disappeared" from the districts in which the crossing has taken place. This prepotency may be taken to indicate not only antiquity of breed but also vigour of constitution.

The alien blood introduced in recent years has been that of the "Lonk," the Scotch "Blackface," and the "Limestone" sheep. The hoped-for improvements do not appear to have been realised, and as the infusions of alien blood have had but small apparent influence in modifying the type of the Gritstones, so it is doubtful if they will effect any marked improvement.

Flocks of Antiquity.—The breed is of high antiquity in the valley of the Goyt, near Buxton. A well-known breeder there, Mr W. Truman, can trace back to the middle of the eighteenth century the possession of these sheep by members of his own family, during which long period the breed has been kept pure and undefiled against alien blood.

Characteristics.

Hardiness.—There can be no doubt, indeed, in the mind of him who has seen these sheep in the wilder parts of the Peak country, amidst the furze and the ling, the rocks and the boulders, that they are exceptionally wiry and sound, possessing immunity from certain ills that lowland sheep are heir to and the energy that is characteristic of denizens of the hills. Hence their physical prepotency when crossed with other breeds of sheep, — prepotency, it will be noted, that is exercised wholly by the ewes of the Gritstone breed, to which rams of other breeds have been

introduced by way of experiment and in hope of good results.

It must be understood, however, that there are many pure-bred flocks of Gritstone sheep in the great districts over which the Society's scope extends. The Society's object is not only to establish pedigree on a sound and readily ascertainable basis, but to secure the identity of pure-blooded animals alive to-day, and to encourage and systematise the propagation of pure blood throughout the wild and mountainous district whose short commons and rigorous climate have made these sheep what they are.

Face-colour, Wool, and Weight.—The Gritstone is not a white-faced, or black-faced, or even brown-faced breed, but "mottled," with irregular patches of black on a white ground, on faces, ears, and legs alike. Their fleeces, however, are free from black spots; free also from hairs and from roughness of "skirt." The wool is fairly long and dense, and of texture that is considered fine. Fleeces of ewes average about 4 lb., of yearlings 6 or 7 lb., and of rams up to 9 or 10 lb. The mutton is said to be of the best quality, and the dressed carcasses average 14 or 15 lb., but sometimes running up to 20 lb. a quarter or more in exceptional cases.

From the parasitic disease known as "liver rot" the Gritstones enjoy enviable immunity, though the land on the mountains, where they roam is in many places water-logged. These sheep, indeed, have thriven and multiplied for centuries, unimpaired, where white-faced breeds of the lowlands would perish in a year.

Scale of Points.

The first volume of the Flock-Book was published in 1907, and has entries of 67 rams and 1306 ewes.

The following is the standard type and points for the breed adjusted by the Society of its breeders:—

	Points.
Face.—Black and white mottled	10
Head.—Fairly long, polled, free from wool, and wedge-shaped	10
Eyes.—Bright and prominent, and set wide apart	5
Ears.—Black and white mottled, and carried slightly forward, but not pricked or drooping	5
Neck.—Medium length, well set on and nicely fleshed, and woolled nearly to the head	10
Body.—Rather long, with well-placed shoulders, good quarters, well-sprung ribs, good top and bottom outlines, well and evenly covered with flesh and wool	20
Wool.—Fairly dense, of medium length and fine texture, free from black spots and hairs, and not rough in the skirt	20
Skin.—Bright and clear pink and free from spots	5
Legs.—Mottled black and white, free from wool, with good bone, joints, and feet, well placed at each corner of the body and set wide apart	10
Tail.—Fairly high and well set on; in the rams long, in the ewes docked	5

MANAGEMENT.

The Derbyshire Gritstone sheep belong to the still existing grass-land breeds. They are yet, to all intents and purposes, gramineous sheep, even in the lower foot-hills of the range. It follows, therefore, that their feeding and management are characterised by simplicity and economy to a degree that cannot be surpassed elsewhere. Grass—commonly enough of the coarsest—is the natural food, year in and year out, of these sheep; and it suits them exactly, for they are proof against flukes and foot-rot, and make a good living on bleak and water-logged soils of which even rabbits fight shy.

The less domesticated flocks of the Gritstone tribe still inhabit the wild moors for the most part, picking up a livelihood where any breed of sheep to the south of them would perish. These are in the semi-wild and wholly natural state which has been the lot of the breed for centuries. The chief trouble with them is to persuade the "roving blades" to keep within reasonable limits of distance from the respective homesteads down below to which they belong.

There are, however, many domesticated flocks of Gritstone sheep away down in the valleys. Some of these have been trained into a fair degree of docility and contentment within boundary fences, but still without extraneous feeding. Grass is the staple food everywhere, with hay in the bitter snowstorms of winter when grass is buried out of reach beneath the snow. They know not the taste of corn,

or even of turnips, and still they breed and thrive to all satisfaction.

The Gritstones are independent of lambing-sheds, however severe the storms of spring may be. Young lambs just born are sometimes taken, with their dams, into sheltered spots, or perchance under an open shed, until they get well on their feet. But commonly enough the lambs are born out in the snow, and are "all alive and kicking" when the shepherd comes on his round in the night. But even then the ewes do not receive any extra food except hay.

It is probable, however, that on some of the valley farms ewes are gradually and experimentally being trained to the taste of concentrated foods as a preparation for coming parturition. This is so indeed, if anywhere, a practice where cross-bred flocks are kept. So far, however, as pure-bred flocks are concerned, all sorts of stimulating foods are considered unnecessary.

A ram of the Derbyshire Gritstone breed is represented in Plate 64.

THE CLUN SHEEP.

The Clun or Clun Forest sheep is chiefly at home in South Shropshire, Radnorshire, and Montgomeryshire. There is a similarity in type of the various races of sheep found on the Welsh Borderland.

Characteristics.

The Clun sheep may be fawn-coloured or mottled, and black in feature. At one time it was a small breed, like most of the other ovine inhabitants of the hills, producing a 3-lb. fleece and killing a dressed weight of 12 lb. per quarter. Bigger sheep were demanded, however, and through the influence of the Ryeland ram the modern type was probably evolved.

The ewes are much in demand for crossing purposes, the large sales established at various centres in Shropshire being attended from all quarters. The Shropshire cross is one of the most popular. The lambs mature early, and produce mutton of first-class quality.

Properly speaking, the Clun sheep is a type rather than a breed, originating with the intermingling of the Ryeland, the Shropshire, and Welsh breeds. Little information of a definite character is available concerning the earlier history of the Clun.

Prof. W. J. Malden, writing on Clun Forest sheep in the *Journal of the Royal Agricultural Society* (vol. iii., 1892), says that the Clun "perhaps does not show the effect of the skill of the breed-maker as do some older established breeds, yet there is undoubtedly in it those characteristics which can be moulded by skilful hands into a sheep which would be hard to beat. The excellence of the meat and wool cannot be denied; while the shapely well-covered head, with slightly Roman nose, the bold scrag, and the free imperious step, denote a robustness with which the breeder may take liberties in order to produce a more rapid maturity without being afraid of rendering it effeminate or weakly. The horns are being bred out." In a good flock the clip will average about 4½ to 5 lb.

MANAGEMENT.

In Clun flocks the rams are put to the ewes from about September 20 to the middle of October, producing on the average about a lamb and a quarter. The ewes are generally drafted out of the flock after two crops of lambs have been taken. They are then sold to go to the lowlands usually to breed lambs for the fat market. The reason why no more than two crops of lambs are taken on the hills is that the mutton value of the ewe depreciates after the second lamb. The wethers and ewes are generally sold when three or four years old, but earlier drafts are made as yearlings and two-year-olds. They vary in price from 35s. to 50s.

During the winter months the flock subsists chiefly on grass, with the addition of hay and clover in bad weather.

OTHER BREEDS OF SHEEP.

The Norfolk.

The Norfolk breed of sheep, one of the most ancient and a parent of the Suffolk, is nowadays in few hands. The

Earl of Leicester and the Executors of the late Colonel M'Calmont both own flocks.

In appearance the Norfolk breed is of coal-black visage and horned. It is a very active sheep, but a slow maturer. The hoggs will clip from 8 to 9 lb., and the ewes from 5½ to 6 lb. wool. As a rule, the wethers are not mature till two years old, when they kill about 30 lb. a quarter.

The breed is prolific, the flock at Cheveley averaging about a lamb and a half to each ewe. Owing to the difficulty of obtaining fresh blood, the breeding of these sheep is naturally close.

Wiltshire Sheep.

The old Wiltshire horned breed of sheep was at one time more kept than now in its native and adjoining counties. They are not, perhaps, such ready feeders as some of the more improved breeds.

Fig. 708.—*Shetland sheep.*

The breed is horned, with white face and legs. For crossing purposes there is a demand for rams from Wales.

Masham Sheep.

A variety of sheep known as the Masham is freely encountered in Yorkshire. It is the product of a cross of the Wensleydale ram on the Scotch Blackface ewe. The Yorkshire Society at one time provided classes for this eminently thrifty type of sheep.

The lambs run with the dams on the high moorlands, the ewes only coming to a lower altitude to lamb, and staying till the young lambs find their feet. They are then sent back to the moors, where they remain, with the exception of dipping and clipping times, till weaned.

The wether lambs find their way to lowland farmers for feeding on turnips. The best of the ewe lambs are drafted out and again crossed with the Wensleydale, producing a three-parts-bred sheep. With this double cross of Wensleydale the best feeding sheep are produced. They are good mutton sheep, and their clip weighs almost as well as the pure breed's. York is a big market centre. No doubt the name Masham arose from the fact that at one time it was the great centre for the disposal of this type of sheep.

Penistone Sheep.

This type is found on the borders of Yorkshire, Lancashire, and Derbyshire. It is, however, dying out. In appearance the sheep are white-faced, with wool of medium length and rather harsh, clipping about 4 to 5 lb. a fleece. No doubt the name is derived from the town of Penistone.

Shetland Sheep.

Amongst the Island varieties of sheep one of the most useful is the Shetland breed. It is a small sheep, not weighing much more when fat than 30 lb. The colour varies greatly, some being black, some white, some brown, and many strangely mixed, as in fig. 708. The body is thick and well set upon short clean legs, the head attractive, and eyes prominent; tail short and fine at the point.

The rams usually have horns; the ewes, as a rule, are hornless, and are excellent mothers. Exceptionally hardy, the sheep thrive well on poor pasture and exposed situations. The wool of the Shetland sheep is of remarkably fine quality, and is turned to admirable account by the natives in the celebrated Shetland shawls and other similar fabrics. The fleece weighs only about 2 lb. The sheep are not clipped, the wool being pulled off by hand.

The breed crosses well with rams of improved breeds.

Other Types.

The sheep of *Iceland* are well suited for the conditions under which they are

Fig. 709.—*Iceland sheep.*

reared, but are not of great value for any part of the mainland. They are small-sized, hardy sheep, some of them with strangely shaped horns, as seen in fig. 709.

The *St Kilda* breed of sheep is a characteristic one, very hardy, with dark-coloured mutton. The wool is fine in texture. Some of the sheep have four or even six horns, growing out from the head with fantastic irregularity.

In different parts of the British Isles there are numerous other types of sheep which are bred to a lesser or greater extent. Amongst these may be mentioned the *Swaledale* sheep of Yorkshire, &c.

FOREIGN BREEDS OF SHEEP.

Of all the foreign and colonial breeds of sheep the best known in this country is the Merino, a Spanish breed that has played a great part in improving the wool-production of sheep in many parts of the world. The outstanding feature of the breed is its remarkable fleece. Every inch of the Merino, from its nose to its hoof, is densely coated with wool so fine as to number up to almost 50,000

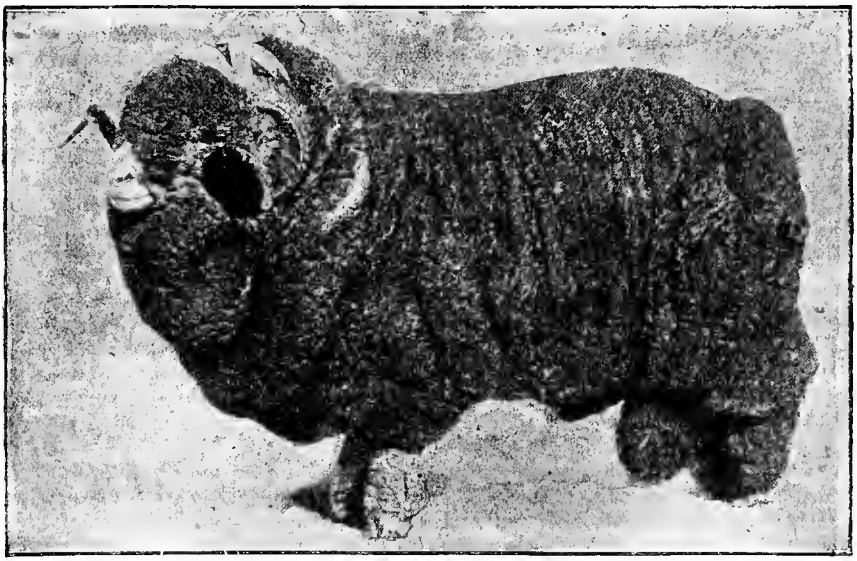


Fig. 710.—*Merino ram.*

fibres to the square inch. And as if to increase the number of square inches, the skin develops into great folds and wrinkles, giving the animal quite the strangely unique appearance shown in fig. 710, reproduced here by permission

from the *Live Stock Journal Almanac*, 1909.[1]

A large quantity of white greasy oil gathers in the Merino fleece. From ewes the fleece weighs 15 lb. or more, and from rams 20 to 25 lb., exceptional animals yielding considerably heavier fleeces.

Merinoes were introduced into England from Spain by King George III. in 1792, and during the first quarter of the nineteenth century the breed was tried to a considerable extent in crossing with several English breeds, including the Southdowns. An improvement was observed in the wool, but the quality of the mutton was deteriorated, and gradually the Merino lost the moderate hold it gained in this country.

In the multitude of other varieties of foreign sheep there are scarcely any whose reputation has extended to this country.

At the great show of live stock in connection with the Paris International Exhibition of 1878 already referred to, there were in all fifty different races and sub-races of sheep, about forty of them being from European countries. Not one of the foreign breeds other than the Merino showed merits that would attract the attention of British flock-owners. Amongst a large number of interesting crosses the best from a British point of view were those bred from the Leicester and Merino races.

GOATS.

The goat has not unfittingly been called the "poor man's cow." In wide districts of Central Europe, in the northern regions of Africa, and in other parts of the world, the peasantry have little else to depend upon for their daily supply of fresh milk and cheese.

Habitat.—Goats are natives of the mountainous countries of the East, notably Asia and Africa. Few domestic animals have so wide a range as the goat. While seeming to thrive best under an ardent sun, they are nevertheless to be found in considerable numbers as far north in Europe as Norway.

At one time goodly numbers of goats were kept in this country, the majority of them being run on the hills like sheep. But this form of rearing, except in Ireland and in some parts of Wales, has now all but ceased. The few goats that are now to be seen in the country districts are kept for most part in ones and twos for milking purposes, and are treated pretty much as a small cow would be. They suit this purpose exceedingly well, and the wonder is that more of them are not kept by cottagers and others having small patches of pasture land.

[1] Vinton & Co., London.

Goats as Milkers.—The improved class of goats are excellent milkers: indeed there is no class of animal of its size that will give a better return in milk for the food consumed than a well-bred goat. Mr Woodiwiss, an English fancier, had a Swiss goat which gave daily for several days in succession 10 lb. 5 oz. of milk, or more than a gallon per day. At the time of the test the little animal had been in milk for more than five months. In another case a herd of five goats, owned by another English breeder, Mr C. A. Gates of Guildford, gave over 3 tons of milk in a year, equal to about 140 gallons each. These goats were also bred from Swiss stock. No doubt yields like these are exceptional, but there are said to be several breeds of goats in the Alpine regions of Switzerland which give regularly during their milking period 3 and up to 5 pints of milk in a day.

In Switzerland the goat is such an important animal that the Government gives a subsidy to selected and approved "Billies," pretty much as in other parts of the Continent and in Ireland premiums are given for bulls. This policy, combined with the skill and enthusiasm of the small owners, has had a most gratifying result, and nowadays most of the

milch goats which are to be seen in this country—at the dairy shows in London and elsewhere—are bred from stock which has been imported from Switzerland or other parts of the European continent.

On account of the restrictive legislation on the importation of live animals into this country it is not easy to import goats, but a few selected specimens for stud purposes can usually still be passed in through the agency of the British Goat Society. In any case, most of the well-known strains are already represented in this country in herds established prior to the practical shutting up of the ports.

Goats' Milk.—Not only is the milk yield of goats surprisingly large in quantity, but it is exceptionally rich in quality. It is not usual for it to fall below 3.50 per cent in fat, and very frequently it reaches 6 or 7 per cent. In 1879 Dr Voelcker, F.R.S., reported on samples of goats' and cows' milk to the effect that they contained respectively 7.02 and 3.43 per cent of pure butter-fat, and 5.27 and 5.12 per cent of sugar. In a later comparative analysis (the cow in this case having won the champion milking prize at the London Dairy Show) the figures stand as follows:—

	Goat's milk.	Cow's milk.
Water	83.21	87.56
Butter-fat	7.30	3.63
Casein	4.18	8.81
Milk-sugar	4.10	
Ash	1.21	
	100.00	100.00

There is still in many minds a slight prejudice against goats' milk on the ground that it has an unpleasantly strong flavour. That prejudice in nearly every case has arisen through drinking the milk of goats kept in a semi-wild state. Where they are kept in captivity and fed on grass, hay, or other low-ground foods, goats' milk has no unpleasant flavour whatever; indeed, were it not for its exceptional sweetness and richness, it would hardly be possible, under these conditions, to distinguish it by taste from cows' milk.

The milk of the goat has the important advantage, that it can be guaranteed practically free from the tubercle bacilli. While as a breed goats are not believed to be entirely immune from the fell disease of tuberculosis, cases of the trouble have occurred so rarely amongst them that it may be said to be practically non-existent. On account of this consideration many people have in late years taken to keeping goats for the supply of milk for children.

Mr Bryan Hook states, in his book on goats,[1] that he adopted the plan of taking a couple of goats with his family to the seaside on the occasion of their annual holiday. The goats were given the run of a little yard behind the house. Their breakfast, given while they were being milked, consisted of a good half-pint of oats or scalded maize, with a double handful of coarse bran, to which was added any available kitchen-refuse. At mid-day they received each an armful of weeds or grass cut from a disused piece of garden, and in the evening they followed members of the family to the beach, where they ranged the neighbouring waste lands for what they could pick up. Their supper consisted, like their breakfast, of corn and bran. The goats did very well with this treatment. At the end of the holiday of six weeks one of them was giving 6 lb. 14 oz. of milk, or nearly 5¾ pints per day. On the basis of the cost of cows' milk this goat gave during the six weeks produce to the value of £2, 7s.

Varieties of Goats.

There are a great many varieties of goats throughout the world. In Switzerland alone there are said to be sixteen practically distinct kinds. There are also the huge shaggy-haired Pyrenean goats, the pigmy goat of Sumatra, the Surats of India, the short-haired reds of Southern Spain, the Nubian goat, and several others besides. While several of these have leading characteristics in common, they vary a good deal in size and colour, as well as in being horned and minus horns.

The common goat which one sees up and down the country, on railway em-

[1] Vinton & Co., London.

bankments and the like, is mainly of Irish origin, or a cross between the Irish goat and one or other of the imported Continental breeds. Occasional Irish goats prove good milkers, but the majority have little to recommend them except their comparatively small price. An objection to the Irish goat from the point of view of those who keep goats for milk is, that they can rarely be induced to breed except as their half-wild nature prompts them. They are therefore of little use for winter milk. Irish goats are nearly always small in size, with long shaggy coats and large horns.

Of the crossed British goats the most successful have been bred from Nubian or Abyssinian strains. The Nubian goats are hornless, and black and tan in colour. The females are, as a rule, good milkers.

Closely resembling the Nubian goats are some of the Indian varieties that have occasionally been brought to this country. While some of these have also proved good milkers, they were not found to stand the climate so well, and have not been largely used.

Swiss Goats.—For milking purposes in this country probably no other kind of goats surpass the Toggenburg and Alpenzell varieties of Switzerland. It was from goats of these breeds that were obtained the large yields of milk already referred to. Both are big-sized, handsome varieties, the Toggenburg especially giving a large yield of milk. In their native districts these goats are taken out and in for milking just as a herd of dairy cows would be in this country. They respond readily to liberal treatment, and cheese is freely made from their milk. Both of these goats are hornless, and both are white in colour, except that the Toggenburger has usually markings on the head.

One of the most beautiful varieties of Swiss goat is the Schwartzhals, which runs for most part at large in the mountains. This breed has short horns, and is black and white in colour. Its flesh is much appreciated by those who like goat meat, but it is not such a good milker as the other two varieties named.

Selection of Goats.

Whatever variety of goat one fancies, it is wise to be careful in making the proper selection. A milch goat should be large, and her udder should correspond to her size. It is found from experience that a large-sized udder means plenty of milk; indeed, in good milkers the udder usually reaches far back between the thighs, and causes the goat to walk with an awkward gait. A good milking goat, too, has prominent eyes, and ears which are rather large; while the horns in the horned breeds should be short and fairly upright in the females, and longish and gracefully turned back in the case of the males. But most of the best milking goats are altogether without horns.

The coat in the case of the native stocks is usually shaggy and rough; in most of the finer imported breeds it is close and short, with a glossy appearance on the surface.

Like the sheep, the goat has no incisors on the upper jaw. There are, however, light incisors on the lower jaw, and these assist the buyer in selecting a young animal. The first pair of incisors fall after the goat has reached a year old; the second, third, and fourth pair after each succeeding year has passed. These young teeth are followed by permanent incisors, which fall out one by one when from seven to eight years has been reached, a good deal depending upon the nature of the food which the animal has been consuming. A goat may be said to have a full mouth at five years old.

In selecting females for breeding, care should be taken to have them high at the shoulder, wide across the loins, and well sprung in the ribs.

MANAGEMENT OF GOATS.

The normal period of the year for mating in the goat is the end of September to the 1st of March, but it may be possible, where the animals are housefed in winter and have in them a dash of Oriental blood, to get them to breed out of the ordinary season. In this way, where numbers are kept, kidding can be done at different periods of the year and a continuous supply of milk kept up.

The period of gestation in the goat is 149 to 154 days, two kids, as a rule, being dropped at each parturition.

Goats live well on grass or other rough pasturage in summer. In winter the best foods are hay, oats, maize, crushed wheat and barley, bran, and occasionally a few ground peas or beans. Turnips are quite suitable where available, and acorns also make a very acceptable food, but they are not always cheaply and easily obtained.

Rearing Kids.—When kids are reared by hand they should be allowed to take milk from the udder during the first three days: thereafter it will be found better to draw it off by hand and teach the kid to drink. If the milk should be too rich, it may be slightly diluted with skim-milk or water. At the end of ten to fourteen days a little well-cooked linseed gruel may be added to the milk, the quantity of which should be reduced. In two or three days further the quantity of gruel may be increased and the milk again diminished, and so on until at twenty days the young animals commence to feed. A female should not be allowed to breed until she has reached the age of eighteen or, better still, twenty months.

Liberal Feeding Required.—Goats, like cows, if they are to milk well, should

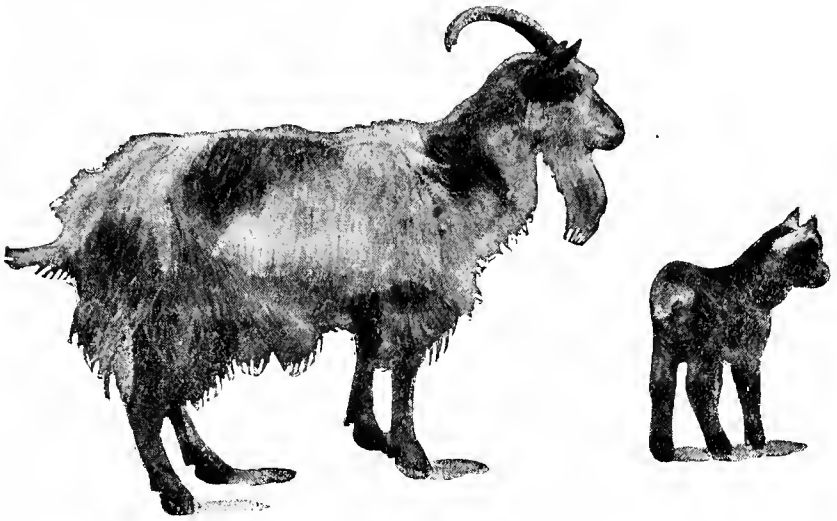


Fig. 711.—*Swiss horned goat and kid.*

be liberally fed. Their food should be varied as much as possible, and only hay of the soundest kind used. In the hilly districts, where they are run like sheep, the animals have to depend mainly on what they can gather, getting only a little hay or straw in winter.

Goats' Hair and Skins.—The hair of goats has a considerable value for upholstery work, and goat-skin rugs are also very useful for carriage and household purposes.

Objections to Goats.—One objection to keeping goats, at any rate in confined quarters, is that the male goat usually has a rather pronounced and penetrating smell, especially in autumn and winter. This is the quality which commends "Billy" to owners of pedigree cattle for running with their cows as a preventive against abortion. Whether it has this effect or not is uncertain, but many people still believe it has, and a "Billy" goat is still part of the equipment of several well-known pedigree herds.

When kept on grass the smell of the "Billy" is not so offensive as when he runs wild. In any case, it does not apply to "Nanny" goats, as the females are generally called. These can be kept under confinement all the year round without the least trouble or objection. Owing to the pugnacious inclination of

many of the animals, it is usually advisable to keep them tied up by the neck in little stalls. A goat will live in about as much accommodation as will suit a medium-sized St Bernard or other large dog.

The country with the largest goat population is India, which has over 24,000,000, Caucasian Russia coming next with over 6,000,000.

A Swiss horned goat and kid are shown in fig. 711.

SWINE AND THEIR MANAGEMENT.

LARGE WHITE PIGS.

The most universally kept and the most popular of English breeds of pigs is admittedly the Large White. Other breeds have been exported, and have assisted to build up the marvellous porcine resources of such countries as the United States, but in Europe, wherever pig-breeding has received prominent attention, the Large or Middle White breed has formed the basis of improvement. Germany, Denmark, Scandinavia, Russia, Austria-Hungary, and other countries have freely imported White pigs from England, and on the strength of the improvement effected have they built up a wonderful bacon trade chiefly with Britain.

Historical.—There are few points in pig-breeding so obscure as the origin of some of our best-known breeds. The improvement of the White pig of England, and indeed the basis of the modern white breeds, is universally credited to Yorkshire. The Neapolitan and the Chinese crosses are spoken of as effecting a partial transformation of the race. Suffice it to say that the Windsor Royal Show of 1851 first set the seal of excellence on the Large White or Improved Yorkshire.

There were several breeders who exercised their skill in this process of evolution, none more prominent than the weaver, Joseph Tuley, and Mr Wainman of Carhead, Yorks. In their days the local shows in the counties of the Rose drew a magnificent entry from small pig-keepers. The extremes of the Large White and the Small White were freely met with in the north of England, and it was not surprising that out of the chaos of conflicting fancy the Middle White should appear.

The Large White pig was then a monster of great excellence, and so long as the public taste was ripe for heavy sides of bacon, breeders continued to supply them.

Type and Characteristics.

The type of pig in demand is regulated by two important factors—the commercial market or bacon factory and the show-ring. We rarely see a pig weighing up to 90 stones nowadays. The tendency is to clear them off at handy weights, for it is more profitable to feed to 8 score than to 16. The Large White as we know it to-day is a different type from that prevailing thirty or forty years ago. All coarseness has been eliminated. The thickness of shoulder has been fined down. The capacity to feed to big weights is dormant, not discarded, for substance is too important in any breed to be lightly dispensed with. The general idea which the breeder has kept in view has been to reduce the cost of feeding the pig by refining those parts where the cheapest pork is grown, and steadily aiming at an early maturing pig of a good bacon type. The following is a description of the breed as approved by the National Pig-Breeders' Association:—

LARGE WHITE.

Colour.—White, free from black hairs, and as far as possible from blue spots on the skin.

Head.—Moderately long, face slightly dished, snout broad, not too much turned up, jowl not too heavy, wide between ears.

Ears.—Long, thin, slightly inclined forward, and fringed with fine hair.

Neck.—Long, and proportionately full to shoulders.
Chest.—Wide and deep.
Shoulders.—Level across the top, not too wide, free from coarseness.
Legs.—Straight and well set, level with the outside of the body, with flat bone.
Pasterns.—Short and springy.
Feet.—Strong, even, and wide.
Back.—Long, level, and wide from neck to rump.
Loin.—Broad.
Tail.—Set high, stout and long, but not coarse, with tassel of fine hair.
Sides.—Deep.
Ribs.—Well sprung.
Belly.—Full, but not flabby, with straight underline.
Flank.—Thick, and well let down.
Quarters.—Long and wide.
Hams.—Broad, full, and deep to hocks.
Coat.—Long and moderately fine.
Action.—Firm and free.
Skin.—Not too thick, quite free from wrinkles.

Large-bred pigs do not fully develop their points until some months old, a pig often proving at a year or fifteen months old a much better animal than could have been anticipated from its appearance at five months, and *vice versâ;* but size and quality are most important.

Objections.—Black hairs, black spots, a curly coat, a coarse mane, short snout, in-bent knees, hollowness at back of shoulders.

Blue spots have not been entirely obliterated, but they are more infrequently met with than used to be the case.

Weights.—The carcase contests at Smithfield Show afford the clearest evidence of the killing qualities of different breeds, assuming of course that the ancient prejudice arising from the colour of a breed is discarded. In these contests the preparation of the animal approximates very closely to feeding for an ordinary market. Pigs are shown of three weights. The youngest age is for pigs not exceeding 100 lb. live-weight, equivalent to about four-score dead. Generally they rather exceed this proportion, killing about 81 or 82 per cent. In the middle age from 100 to 220 lb. live-weight; in 1907 one Large White weighed 193 lb. alive and dressed 153 lb. The daily gain in live-weight was 12.2 oz. In the class for big pigs between 220 lb. and 300 lb. live-weight, the Large White and Large Black cross was successful, making the very rapid daily gain in live-weight of 1 lb. 3 oz., and dressing a 236 lb. carcase from an arrival-weight of 288 lb.

Prolificacy.—The Large White is a prolific breed, and the sows are good mothers. Litters of twelve to sixteen are not uncommon.

A boar and a sow of the Large White breed are represented in Plate 65.

MIDDLE WHITE PIGS.

Many breeders whose views carry weight unhesitatingly affirm that they have found the Middle White the most profitable type of pig.

Origin.—The Middle White is undoubtedly a compound of the joint excellencies of the Large and Small White breeds, both of which were commonly kept and shown in Yorkshire and Lancashire many years ago.

The Middle White has come to be regarded as a distinct type. It is occasionally found creeping out in the Large White, particularly at fat stock shows. To the Yorkshire breeder is attributed the originating of the Middle White, and at a Yorkshire show it first found separate classification. The breed is not so well diffused as the Large White, and fewer opportunities are afforded by agricultural societies for its exhibition.

Characteristics.

The Middle White pig occupies a position that is difficult to maintain. In the first place, we frequently meet with rather large-framed pigs with decided Middle characteristics of countenance and type. Conversely we are more frequently confronted with under-sized pigs, the chief difficulty being not to strike but to maintain the happy medium which justifies the breed's existence. In some ways the Middle is a White Berkshire. They have points in common, save that a little more size than is common in the White breed is favoured in the Blacks.

Scale of Points.

The approved points of the Middle White pig are thus indicated by the National Pig-Breeders' Association:—

Colour.—White, free from black hairs or blue spots on the skin.
Head.—Moderately short face dished, snout broad and turned up, jowl full, wide between ears.
Ears.—Fairly large, carried erect and fringed with fine hair.
Neck.—Medium length, proportionately full to the shoulders.
Chest.—Wide and deep.
Shoulders.—Level across the top, moderately wide, free from coarseness.
Legs.—Straight and well set, level with the outside of body with fine bone.
Pasterns.—Short and springy.
Feet.—Strong, even, and wide.
Back.—Long, level, and wide from neck to rump.
Loin.—Broad.
Tail.—Set high, moderately long, but not coarse, with tassel of fine hair.
Sides.—Deep.
Ribs.—Well sprung.
Belly.—Full, but not flabby, with straight underline.
Flank.—Thick and well let down.
Quarters.—Long and wide.
Hams.—Broad, full, and deep to hocks.
Coat.—Long, fine, and silky.
Action.—Firm and free.
Skin.—Fine, and quite free from wrinkles.
Objections.—Black hairs, black or blue spots, a coarse main, in-bent knees, hollowness at back of shoulders, wrinkled skin.

Weights.—The chief merits of the Middle White are its capacity to fatten readily, its docility, and prolificacy. It is particularly well suited to produce the 8-score pig now so much in demand. Breeders are seeking a lengthy pig, as the middle piece with its wealthy cut of streaky meat is the most valuable portion of the pig.

Prolificacy.—The prolificacy of the Middle White is a strong point in its favour. Litters run from ten to thirteen in number, and will average double figures. No doubt the reason for the superior prolificacy of the White breeds is that at one time an extra pair of teats was cultivated as being a strong point in a sow.

A Middle White sow is represented in Plate 66.

LARGE WHITE ULSTER PIG.

Of the multiplication of breeds, like the making of books, there seems to be no end. The Royal Ulster Agricultural Society has established a Register of the native breed of pigs in Ulster known as the Large White Ulster. Classes are provided for the breed at the Belfast Spring Show.

Scale of Points.

The following is the official scale of points of the breed:—

	Points.
Head.—Moderately long, wide between the ears	5
Ears.—Long, thin, and inclined well over the face	6
Jowl.—Light	5
Neck.—Fairly long and muscular	2
Chest.—Wide and deep	3
Shoulders.—Not coarse, oblique, narrow plate	8
Legs.—Short, straight, and well set, level with the outside of the body, with flat bone not coarse	5
Pasterns.—Straight	
Back.—Long and level (rising a little to centre of back not objected to)	12
Sides.—Very deep	10
Ribs.—Well sprung	5
Loin.—Broad	3
Quarters.—Long, wide, and not drooping	8
Hams.—Large and well filled to hocks	12
Belly and Flank.—Thick and well filled	5
Tail.—Well set and not coarse	1
Skin.—Fine and soft	10
Coat.—Small quantity of fine silky hair	
Total	100

Objections.

Head.—Narrow forehead.
Ears.—Thick, coarse, or pricked.
Coat.—Coarse or curly; bristly mane.
Colour.—Any other colour than white is a disqualification.

The breed has for many years been reared with success in the north of Ireland, and in recent years a good deal of attention has been given to its improvement. In form and characteristics generally it resembles the Large White English breed, which has been used to a considerable extent in its development.

An outstanding difference between the Ulster and Large White breeds is in the length and formation of the ear, the Ulster pig having exceptionally long ears.

A portrait of a Large White Ulster boar is given in Plate 66.

THE BERKSHIRE PIG.

The Berkshire pig has greatly extended its sphere of influence since the nineteenth century entered upon its closing quarter. The origin of this, as of most of our other breeds of pigs, is a matter of conjecture, and it is immaterial whether or not the Neapolitan Black pig was used in its production. Certain it is that the Berkshire pig, as it is known to-day, is a very different animal from the Berkshire of the early half of last century.

Characteristics.

It is sometimes a fault of the show-yard that it is liable to emphasise minor and fancy points to the detriment of commercial qualities. If it has not altogether succeeded in doing so with the present-day Berkshire, it has at least exercised an influence that has not always been for good.

Many breeders deplore the extent to which the markings of the breed hold sway in the minds of show judges. Any one acquainted with leading herds of Berkshires knows that many of the very best pigs have practically to be discarded because they lack a white hair in the tail, or because a few white hairs appear on the tip of the ear.

Scale of Points.

The British Berkshire Society has drawn up the following revised standard of excellence :—

Colour.—Black, with white on face, feet, and tip of tail.
Skin.—Fine, and free from wrinkles.
Hair.—Long, fine, and plentiful.
Head.—Moderately short, face dished, snout broad, and wide between the eyes and ears.
Ears.—Fairly large, carried erect or slightly inclined forward, and fringed with fine hair.
Neck.—Medium length, evenly set on shoulders; jowl full and not heavy.
Shoulders.—Fine and well sloped backwards, free from coarseness.
Back.—Long and straight, ribs well sprung, sides deep.
Hams.—Wide, and deep to hocks.
Tail.—Set high, and fairly large.
Flank.—Thick and well let down, making straight underline.
Legs and Feet.—Short, straight, and strong, set wide apart, and hoofs nearly erect.
Objections.—A perfectly black face, foot, or tail; a rose back; white or sandy spots on the body; a white ear; a very coarse mane; or in-bent knees.

Size.—There is no doubt that the Berkshire pig has deteriorated in size. In the days of the old Berkshire, when sandy spots were not uncommon, pigs grew to greater weights than they do nowadays. Breeders, however, affirm that the trade for very heavy pigs is merely local, and that medium weights find the readiest markets. The pig that kills 8 score under nine months old can command a good price. At the Smithfield Show of 1907 the champion in the carcase section was a Berkshire which, at 255 days old, weighed 190 lb. alive and 158 lb. dead, equivalent to a daily gain of close on ¾ lb. If the Smithfield carcase contests teach anything, it is that the Berkshire can mature quite as rapidly as, if not more rapidly than, other breeds.

Distribution of Berkshires.—The Berkshire pig is in full strength in the county from which it takes its name. It is found all over the south of England, where a black pig seems mostly favoured. The counties south of the Thames afford it most encouragement. No doubt the fact that a black pig is less liable to blister than a white pig has something to do with its popularity. The Berkshire is not quite so hardy as the Large White.

Changes in Type.—Changes in the type of pig favoured are not infrequent. They vary according to the accepted notions of breeders. Most of them object to a very pug face and prominent jowl, the chief difference of opinion arising over the length of snout. The necessity of maintaining the dish face is not disputed, as it is characteristic. A longer type of pig is more favoured than was the case some years ago. Breeders recognise that to have a bacon pig of the highest standing in the market length of side is necessary.

For Crossing.—The Berkshire is one of the most valuable breeds for crossing. A point that should be noted, however, in connection with this breed is the danger which some believe exists in

using in a pure herd a boar which has been employed for crossing with white pigs. They say it will almost inevitably result in badly marked litters.

Prolificacy.—Although not so prolific as the Large White, the Berkshire rears a good litter, averaging about eight pigs reared. Breeders reckon that ten is a very good litter for a mature sow to rear.

A portrait of a Berkshire sow is presented in Plate 67.

LARGE BLACK PIGS.

The Large Black pig has risen from comparative obscurity to rank as one of our most useful registered breeds.

Progress.—The Large Black Pig Society was established as recently as 1899, but during its brief existence it has contrived to bring the breed very much under notice of the public.

At one time an excellent farm-scavenger, the breed has risen to a higher point of excellence than merely grubbing for a living. In the showyard nothing has been more remarkable than the progress made by breeders in bringing out their stock. Experience has enabled them to bring out their exhibits in condition more in keeping with the standard adopted in other breeds.

Characteristics.

The Large Black is designed as a bacon pig. It has been conclusively shown that in point of flesh-making, attested by the weighbridge, this breed can hold its own. Perhaps it provides most profit for the feeder as a 10 to 11 score carcase pig. In the past some great weights have been achieved, as much as 190 lb. per side dead. At the present time the breed is used more for the production of heavy than early and handy weights, but as early maturity becomes more recognised as the best and cheapest form of bacon production, we may expect the feeder to turn over more capital by keeping more sows and shortening the store period in a pig's life. The proportion of lean to fat is considerable, and the prolificacy of the breed one of its strong features.

Scale of Points.

The following is the scale of points drawn up by the Breed Society:—

	Points.
Head.—Medium length, and wide between the ears	5
Ears.—Long, thin, and inclined well over the face	6
Jowl.—Medium size	3
Neck.—Fairly long and muscular	3
Chest.—Wide and deep	3
Shoulders.—Oblique, with narrow plate	6
Back.—Long and level (rising a little to centre of back not objected to)	12
Sides.—Very deep	10
Ribs.—Well sprung	5
Loin.—Broad	5
Quarters.—Long, wide, and not drooping	8
Hams.—Large, and well filled to hocks	10
Tail.—Set high, and not coarse	3
Legs.—Short and straight	5
Belly and Flank.—Thick and well filled	8
Skin.—Fine and soft	4
Coat.—Moderate quantity of straight, silky hair	4
Total	100

Disqualification.

Colour.—Any other colour than black is a disqualification.

Objections.

Head.—Narrow forehead or "dished nose."
Ears.—Thick, coarse, or pricked.
Coat.—Coarse or curly; bristly mane.

Weights.—If evidence were required of the great weights to which this breed can and does grow, the reader might be referred to the figures of the Smithfield Show catalogues.

Location.—The breed is located chiefly in Devon and Cornwall in the west, in Suffolk and Essex in the east, and in Sussex in the south. A number of pigs have been sent abroad, and the demand for them continues to expand.

A Large Black sow is represented in Plate 67.

THE TAMWORTH PIG.

The Tamworth is one of the old breeds of pigs handed down to the present generation from the time of forests and unenclosed lands. It is distinct from every other breed of pig that we possess—distinct in colour, form, and character.

Origin and Progress.—The Tam-

worth pig is a native of the Midland counties of England, where it is frequently seen running at pasture and about homesteads. Nature designed the Tamworth to be its own forager. It is remarkably active, and during the past twenty or thirty years has undergone some change, doubtless chiefly owing to careful selection and mating.

It is under the fostering care of a special Breed Society, although for many years, along with the White breeds, its interests were looked after by the National Pig-Breeders' Association. The colour favoured is a beautiful golden russet. It is not an easy matter keeping to the correct hue, and sometimes equally difficult to discard the spotted skin.

Scale of Points.

The standard of excellence adopted on behalf of the breed is as follows:—

Colour.—Golden red hair on a flesh-coloured skin, free from black.
Head.—Fairly long, snout moderately long and quite straight, face slightly dished, wide between ears.
Ears.—Rather large, with fine fringe, carried rigid and inclined slightly forward.
Neck.—Fairly long and muscular, especially in boar.
Chest.—Wide and deep.
Shoulders.—Fine, slanting, and well set.
Legs.—Strong and shapely, with plenty of bone, and set well outside body.
Pasterns.—Strong and sloping.
Feet.—Strong, and of fair size.
Back.—Long and straight.
Loin.—Strong and broad.
Tail.—Set on high and well tasselled.
Sides.—Long and deep.
Ribs.—Well sprung, and extending well up to flank.
Belly.—Deep, with straight underline.
Flank.—Full and well let down.
Quarters.—Long, wide, and straight from hip to tail.
Hams.—Broad and full, well let down to hocks.
Coat.—Abundant, long, straight, and fine.
Action.—Firm and free.

Objections.—Black hair, very light or ginger hair, curly coat, coarse mane, black spots on skin, slouch or drooping ears, short or turned-up snout, heavy shoulders, wrinkled skin, in-bent knees, hollowness at back of shoulders.

Form and Fattening Properties.—Great progress has been made in grading up the fleshing qualities of the breed. The best Tamworths of to-day are deeply fleshed, with a greater width of top than was at one time discernible. It is eminently a bacon pig, and for a judicious mixture of flesh and fat no breed can show a finer side of bacon.

Fresh Blood Wanted.—One of the leading breeders has declared that unless fresh blood can be imported from America the progress of the pure-bred Tamworth is impossible. Undoubtedly breeders work under great disadvantages. Those in the front rank who stand high in the show-ring are very few, and the difficulty of securing an out-cross of blood is a serious matter.

Character.—As a farmer's pig the Tamworth perhaps lacks depth, but it is a good farm-scavenger. It is in all probability not the sweetest-tempered of our breeds, and is given to rooting; but those who have had most experience of it declare that it grows to weight well, finds a ready market for bacon purposes, and crosses well with the Berkshire.

A portrait of a Tamworth sow is given in Plate 68.

LINCOLNSHIRE CURLY-COATED PIGS.

Lincolnshire has its own breed of pigs which have attained to a separate and corporate existence.

Characteristics.

The Lincolnshire Curly-coated pig has some points in common with the Large White, from which, however, it is essentially different. It is a quick-growing variety, with more capacity to turn out prime fat pork than bacon. Those who have had most experience of it declare that it has no rival in the Fen county for early maturity.

To understand the Lincolnshire farmer's point of view, it must be remembered that the native live stock of all descriptions are of exceptional scale. The Shire horse, the Red Shorthorn, and the Lincoln sheep are all of remarkable stature. The Curly-coated pig harmonises with accepted local ideas in live-stock breeding. It is descended from earlier times when the yeoman families in the county were more numerous than now.

On the fen lands and marshes pigs are largely kept, frequently mustering herds to the number of 100 head and over. They run in the open, thus acquiring constitutional vigour and strength of frame. The latter is doubtless attained from the soil and climate. It is a custom of the county to allow the labourers a measure of pork in lieu of wages, consequently there is a strong demand for fat pork locally.

Appearance.—In appearance the Lincoln Curly-coated pig is white, with curly or wavy hair, with blue spots not infrequently found on the skin. The head should not be too long, the nose must be straight, without the suspicion of a dish, the ears thick and pendent but not obscuring the eyes. The body should be square and symmetrical, the shoulders wide set and deep, the belly parts thick and close to the ground, the legs straight, and the weight of bone pronounced.

It is only natural in these days, when pedigree is the great directing force in stock-breeding, that a breed or distinct variety with which Youatt was familiar should be placed on a registered basis. A society was formed in 1906 at Boston, and the first Herd Book issued in 1907.

Scale of Points.

This society drew up a scale of points as follows:—

	Points.
Colour.—White.	
Face and Neck.—Medium length and wide between eyes and ears	5
Ears.—Medium length and not too much over face	10
Jowl.—Heavy	3
Chest.—Wide and deep	3
Shoulders.—Wide	15
Back.—Long and level	10
Sides.—Very deep and ribs well sprung	10
Loin.—Broad	5
Quarters.—Long, wide, and not drooping	5
Hams.—Large and well filled to hocks	15
Tail.—Set high and thick	3
Legs.—Short and straight	5
Belly and Flank.—Thick and well filled	3
Coat.—Fair quantity of curly or wavy hair	8
Total	100

It is objectionable to have a narrow forehead and thin ears. If the ears are pricked, the nose dished or long, the coat coarse, strong, or bristly, or the colour of the hair other than white, the pig would be practically disqualified.

Weights.—At from 9 to 12 months pigs weigh up to 30 imperial stones. The sows are stated to be good mothers, and are usually fed after producing one litter. At 20 months old they weigh from 40 stones upwards. As indicative of the capacity of this breed to grow weighty pigs, an interesting contrast is made of the two winning gelts at the Lincoln County Show at Gainsborough in 1906 and the weight of the champion cup winners at Smithfield in the same year. The former at 10 months 2 weeks 2 days old weighed 8 cwt. 15 lb.; and the latter, a cross-bred pen, at 11 months 2 weeks 2 days old scaled 7 cwt. 2 qrs. 27 lb.

A Lincoln Curly boar is represented in Plate 68.

SMALL BREEDS OF PIGS.

The star of the small pig breeds has set. There is not now that demand for very fat small pigs that at one time existed, consequently the Small White and the Small Black breeds as commercial assets on the farm are all but non-existent.

The Small White.

The Small White variety is still kept as a "Fancy" pig. It has been brought to a wonderful state of perfection. It is a pure white in colour, with a dished head and broad turned-up snout. It is very full about the jowl, and breadth between the small erect ears is a characteristic feature. Its shoulders are wide, chest full, back broad, and sides deep. It is set on short legs, is small in stature, and ought to be free from wrinkles.

Small Black Pigs.

The Small Black is closely allied to the Black Suffolk, the black pigs of the neighbouring counties of Essex and Suffolk having much in common both in form and character.

The Small Black is a very straight symmetrical pig, set on short legs, very fine in bone. The snout is short and slightly dished, but essentially different in point of character from the full squat face of the Small White. The coat of the Small Black is somewhat strong.

This breed is an easy and rapid fattener, and this property, coupled with greater size than is apparent in the Small White, makes the Suffolk cross appreciated by farmers. The Small Black is decidedly prolific, the litter usually reaching double figures. Its chief defect, apart from lack of size, is a tendency to produce too great a proportion of fat to lean in the carcase.

OTHER TYPES OF PIGS.

Apart from the recognised and registered breeds of pigs there are many porcine types associated with different counties.

The **Black Dorset**, for instance, has a long-established local reputation. It is credited with a good character for ordinary farm purposes.

The **Improved Dorset**, as it was known in later years, was probably a cross on the native breed.

In Sussex there is frequently found on farms a black pig, which enjoys a good reputation locally. It is almost slate-coloured. It has length of body but is lacking in quality. This type is largely used in the production of "four-score" pigs for the neighbouring markets.

The **Hampshire Pig** has points in common with those kept in the neighbouring counties.

The **Gloucestershire Spotted Pig** is largely reared in that county. In the Midlands black and white spotted pigs are also to be found.

MANAGEMENT OF PIGS.

Farrowing.

There is as much diversity of opinion as to the best system to adopt with a sow at the time of farrowing as there appears to be on most other points connected with the management of pigs. Some persons advise that the sow should be left entirely to herself whilst she is farrowing, and others just as strongly urge that the sow ought to have some one in attendance on her.

There is much to be said in favour of both systems,—everything depending on the temperament of the sow and the manner in which she has been previously treated.

Many of the common "anyway-bred" country sows, whose time is spent in a strenuous search for the bare necessaries of life, and whose aim is to give as wide a berth as possible to every human being lest they should meet with the punishment they have already deserved (or most likely will, at some future time, deserve) for their predatory habits, resent the presence of an attendant when they are farrowing. At such a time sows of this class are naturally in a somewhat excited condition.

On the other hand, the well-bred, carefully tended sow, whose experience of man is of an exactly opposite nature, appears to like rather than dislike the attendance of the person who is in the habit of feeding and looking after her. It would, of course, be most unwise to have a stranger to attend to the sow at such a time. In most of the leading piggeries it is the custom for the pigman to be with sows at the time of farrowing, and it is only in exceptional cases that sows give serious trouble with their tempers if they are kindly and carefully treated.

Occasionally a sow, when farrowing her first litter, becomes rather excited, especially when the newly-born pigs happen to come near her head in struggling on to their legs in search of the teat. The wisest course is to gently remove the pigs as farrowing proceeds, and thereafter return them to the sow, when the excitement will most probably have passed away.

Preparation for Farrowing.—It is a good plan to have the sow placed in the sty or house where it is intended that she should farrow, at least a fortnight before her time is up.

Period of Gestation.—The period of gestation with sows is as nearly as possible sixteen weeks. Some aged sows, and yelts with their first litters, will often farrow a day or two before the four months have elapsed; whilst the more robust sows will as frequently carry their pigs one hundred and fifteen or eighteen days, and in a few cases even a little longer.

Symptoms of Farrowing.—The pigman will easily foretell the arrival of the

litter. The sow will be restless, her udder will become swollen and heated, and on the teats being drawn, moisture of a sticky glutinous nature, and sometimes milk, will be found at least twelve hours before the little pigs arrive on the scene; the vulva will become enlarged, and the muscles on either side of the tail will give way.

Bedding for Young Pigs.—It is not advisable to allow the sow to have much long straw for bedding during the first few days after she has pigged, or the little pigs may become entangled in it, and get lain upon by the sow. Some persons give their sows at this time long cut chaff for bedding, but the best material for the purpose is the wheat screenings or "cavings" from the riddles of the threshing-machine. This is both short and soft, and has no sharp ends such as are found in cut chaff.

Treatment of the Sow and Produce in Farrowing.—When the sow commences to farrow, the attendant should have ready a three-dozen size hamper, three-parts filled with wheat-straw, and as the little pigs come into the world they should be wiped with a cloth, placed to a teat so that they obtain a few drops of milk, and then put into the hamper, where they will rest contented and warm until the sow has finished farrowing—unless it be a very prolonged case. In the latter event the piglings should be taken out of the hamper and placed near the udder of the sow, when they will soon begin to forage about for that which nature almost invariably provides for them.

After the sow has suckled the pigs it will be advisable to again place them in the hamper and to give the sow a little slop composed of bran and sharps stirred with tepid water or skim-milk. The sow will then soon lie down again, when the pigs may be placed with her, and the family party will generally rest comfortably until the return of feeding-time. In cold weather it is better to cover the hamper with a sack or cloth, as the little pigs are easily chilled before they have become dry.

The After-birth.—In some cases the sow is allowed to eat the placenta or after-birth. This should be carefully avoided. The placenta should be removed from the sty as soon as it is clear of the sow.

It will be found advisable to walk the sow out of the sty the day after she has farrowed. The little exercise will generally cause her to relieve the bowels and the bladder.

Assistance in Farrowing.—It is not often that the sow requires any assistance in farrowing, but it will occasionally be necessary to give her help. Sometimes the little pig will present itself crosswise. At other times there may be a double presentation, or the fœtus be abnormally large. There is seldom any great difficulty in relieving the sow. The great essentials are patience, care, and a plentiful supply of lard. The hand and arm of the operator should be small and well smeared with grease. After farrowing, 2 oz. of sulphur and ¼ oz. of nitre should be given to her in a pint of skim-milk or thin gruel. She will readily drink this, and generally it will be all the medicine needed.

Pigs Biting Sow's Udder.—It will sometimes be found that when the newly born pigs are placed with the sow, they will fight for the teats to such an extent as to bite the udder of the sow, which at the time is especially sensitive. The sow will jump up in a hurry, and should no steps be taken to prevent the youngsters injuring her, she will often lie flat on her body and refuse to suckle the little pigs. This occurs more frequently when the sow carries her pigs beyond the usual period of sixteen weeks. The eight tusk-like teeth of the piglings will be found abnormally long, and generally of a dark colour at the root. Old-fashioned pigmen were wont to say that "these black-teethed pigs are never any good, and are sure to pine away and die." In this they were doubtless correct, unless the simple remedy of breaking off these offending teeth was applied. If this were not done the pigs would naturally become more hungry, and consequently more combative, whilst the sow's udder would become more sensitive and inflamed owing to the milk not being extracted. The usual result would be that the pigs would be starved to death from want of their natural food, and the sow would suffer from inflammation of the udder.

The remedy, a most simple and efficacious one, is to remove the pigs out of hearing of the sow, and to cut off the teeth of the piglings well into the gums with a small pair of cutting-pliers. If the pigs are then placed with the sow no further trouble will be experienced. Each pig will soon settle down to its selected teat, which it will make its headquarters for obtaining lacteal nutriment until it is weaned.

Weaning Pigs. — This should take place when the pigs are about six weeks old, if in summer, and about eight weeks old in the colder months. The weaning should be done gradually, by extending the time during the last eight or ten days of keeping the sow from the pigs.

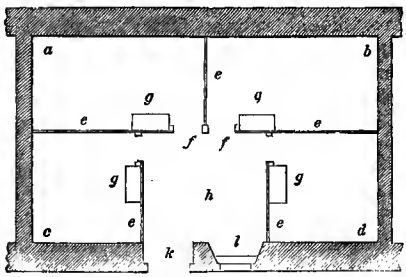


Fig. 712.—*Sties for brood-sows under one roof.*

a b Two sties, 7½ by 12 feet.
c d Two sties, 7½ by 8 feet.
e e e Wooden partitions.
f f Four doors of sties.
g g g g A feeding-trough in each sty.
h Area from which to overlook the sties and to fill the troughs.
k Outer door of sties.
l Window for the sties.

Housing Brood-sows.—In the section on Farm Buildings in vol. i. information is given as to the construction of house accommodation for pigs (see vol. i. p. 184). Fig. 712 represents an arrangement of four sties or compartments for brood-sows, all under one roof, and communicating with a compartment in which the attendant may provide a bed for himself. It is a great advantage to have stout battens fixed along the sides of that part of the sty on which the bedding is laid. The battens require to be from 1½ to 1¾ inch thick, and from 4 to 6 inches broad, depending somewhat on the strength and nature of the wood. They should be firmly fixed with their under surface from 8 to 9 inches above the level of the floor, and should be at least 4 inches distant from the wall.

Galvanised iron tubing 2½ inches in diameter may be used instead of the battens, and is considered better from a sanitary point of view, but the iron is cold. The wood is much more comfortable for the pigs.

This arrangement is a useful protection to the young pigs, as they can creep in between the mother and the wall and obtain a share of the maternal warmth without running the risk of being overlaid. The expense incurred will soon be repaid in the saving of the lives of the young pigs.

Drains proceed from all the sties to the nearest liquid-manure drain; and the apartment is rendered comfortable by having the ceiling and walls plastered, a ventilator placed on the roof in connection with the ceiling, and the floor of brick. When two sows only are kept, the other two sties may be occupied by the weaned pigs.

Prolificacy in Swine.—In the different varieties, and even in the different strains or families of each breed of pigs, there is a marked difference in the prolific powers. This is most noticeable in those strains which have been bred for a number of years for showyard points alone, without due regard to those more useful and general-purpose qualities which are the only really valuable ones for the pig-breeder to study and cultivate. We would not for one moment wish to be understood as expressing the opinion that prolificacy, utility, and ability to win prizes are not to be found combined in several families or tribes of the different kinds of pigs. There are, indeed, numerous instances of such a happy blending, but it is undeniable that the rule is "the other way about."

Sows are capable of breeding—that is, of conceiving—when about seven months old; but it is imprudent to begin at such an early age. About the eighth month is quite soon enough to mate a sow with the boar.

A good breeding-sow will produce and nurse two litters in a year.

Seasons for Farrowing.

In former times it was the prevailing custom for farmers to fatten pigs during

autumn and winter only rather than through the year. This was a mistaken practice, for it is well established that a feeding-pig will make considerably greater increase in condition from a given quantity of food fed to it in cool quarters during the summer months than in cold weather. Moreover, the average price of pork in the months of July, August, and September is higher than in the winter months.

These considerations, together with changes in methods of bacon-curing and in the tastes of the consuming public, have led to the abandonment of the old custom, and to the introduction of the practice of carrying on the fattening of pigs throughout almost the whole year.

An inevitable accompaniment of these changes has been the extension of the farrowing season over at least ten of the twelve months; and the greater difficulties to be encountered in the rearing of very young pigs in the cold season of the year render it more important now than ever that pig-men should be well trained for their duties.

Early Maturity in Pigs.—In no other class of stock does "early maturity" pay the feeder better than with pigs. Young pork commands a readier sale and higher price than old. Then the saving of food is important. It is generally considered that a pig of 100 lb. weight requires about 3 lb. of corn per day simply to keep the animal machinery going—merely to supply animal heat and repair the natural waste in the body. It therefore follows that if, by judicious feeding and attention, a pig can be made to realise as much at seven months old as one managed after the old-fashioned plan would at the age of twelve months, the gain in food alone must be substantial. And, in addition to this, there would be a saving in the cost of attendance and risk.

Attention to Pig-rearing.—There are thus several important circumstances which favour the feeding of pigs in summer and autumn rather than in winter. Economy in pig-feeding should have as careful consideration as economy in any of the more important operations of the farm, yet it is well known that, as a rule, farmers give but little thought to the management of pigs. Too often pigs are looked upon as little else than the scavengers of the farm. This is a great and unfortunate error, for with proper management pigs generally pay well. Indeed it may be doubted if any other variety of stock will give a better or quicker return for kind and judicious treatment and liberal feeding than may be obtained from a good class of pigs.

The pig assuredly deserves more attention from the general body of farmers than it has hitherto received. An important point, we have seen, in the profitable management of pigs is the season of the year in which the fattening is mainly carried out. Swine are more susceptible of cold than either cattle or sheep; and, upon the whole, it is desirable that farmers should aim at fattening the majority of their pigs (except porkers for home consumption) between March and October.

Winter Farrowing Risky.—Litters of young pigs are troublesome and risky in winter, and are to be avoided except where the delicacy of roast sucking-pig is desired at the Christmas dinner. But although the feeding of pigs should be carried out mainly in the warmer months, there will always be less or more pig-feeding in winter—perhaps a few pigs of late litters to finish off, or it may be only two or three young porkers for home consumption during winter and spring. For information on the feeding and general management of swine we are mainly indebted to Mr Sanders Spencer, Holywell Croft, St Ives, who has made the profitable breeding and rearing of pigs a life-study.

Rearing and Feeding Pigs.

In the methods of pig-feeding pursued throughout the country there is great variation, much depending upon the foods most economically available, and the purposes for which the animals are being prepared.

Feeding the Sow and her Litter.—It may be assumed that six is a fair number for a young sow or yilt, and ten to twelve for an aged sow, to rear at each litter. These numbers may be larger in the summer months, but it will be found most profitable not to attempt too much in pig-breeding any more than

in most other things. From the time the piglets are three days to about four weeks old, the sow should be fed twice a-day with just about as much as she will clear up at once of thoroughly stirred slop, composed of seven-eighth sharps, thirds, or randan, and one-eighth broad bran. By this time, or even before, the little pigs will begin to lick round the trough, and show signs of a desire to become less dependent on their mother for the necessaries of life. This natural want must be satisfied either by allowing the sow to have a run on the grass field or in the straw-yard for an hour or two, or, if the weather is too rough and cold, letting the little pigs into an adjoining place, and there feeding them with a little sharps, or oatmeal stirred with milk; or a small quantity of oats, peas, or wheat will be thankfully received and turned to good account by the now hungry "squeakers."

This system of feeding may be continued until the pigs are weaned, the only variations being a gradual addition to the food given to both sow and pigs, and the warming of the milk or water with which the food for the little pigs is mixed during the cold weather.

Weaning Pigs.—The little pigs will be best left on the sow in the summer months until they are seven or eight weeks old, and in the winter months a week or two longer. The weaning should be effected gradually, by letting the sow remain away from the pigs a little longer time each day until the flow of milk gradually ceases, and the pigs think more of the arrival of the pail than of their mother. By adopting this plan the sow's milk will be no trouble, and the sow will desire to receive the attentions of the boar within two or three days after the pigs are weaned.

Castrating Pigs.—Those little pigs which are not required for breeding purposes should be attended to when they are about five or six weeks old. This is by no means a difficult operation, but it is better to employ a competent castrator, especially with the sow pigs, or, as they are variously termed, hilts, elts, yilts, yelts, gilts, or gelts.

Feeding Young Pigs. — After the pigs are weaned, their food should be very similar to that on which they had been previously fed, with the addition of a few more peas. As the pigs reach the age of three months, a proportion, amounting to one-sixth, of barley-meal may be added. This may be gradually increased until it becomes the principal food of a five-months-old pig.

Cocoa-nut Meal for Pigs. — We have of late years used a considerable quantity of cocoa-nut meal, and have found it a most economical food to use with the barley-meal. From experiments carried out at our wish, it was proved that not only was pork made at a less expense by the introduction of cocoa-nut meal to the extent of about one-eighth of the whole allowance of food, but the quality of the flesh was superior, and the appearance of the carcase much improved.

Cod-liver Oil for Pigs.—Owing to the high price charged until recently for cod-liver oil, its use for stock has been very slight; but it may now be procured at such a reasonable price as to come within the limit of profitable foods for young growing pigs, if not for those in the fattening stage. The flavour of the pork is affected if the oil be used within a month of the pig being killed, but we can recommend it with every confidence for newly weaned pigs and young stores. During one winter we have given it to some two or three hundred young boars and gilts which were being reared for the spring trade, and the result was most satisfactory.

A Golden Rule in Pig-feeding.—If it be desired to rear and fatten pigs at a profit, one "golden rule" must not be lost sight of—*never allow the pigs to become poor.* Keep them ever in a progressive state, and if this is done properly, they will be fit for the butcher a month or two earlier than is the rule, while the pork will be of better quality, and the loss from disease will be reduced to a minimum. Should illness attack any of the pigs, they will thus be always fit for the knife, and realise pretty nearly their full value.

Variety of Food.—Variety of food is as beneficial and as welcome to pigs as to human beings. It may not be practicable to change the course of feeding to any great extent, but it will certainly be beneficial to give the fattening and

even the growing pigs a *mixture* of meals.

Meals for Pigs.—Barley-meal has been proved to be the best single food for fattening pigs, and to a great extent it is necessary for the manufacture of a high quality of meat. Maize-meal may be used somewhat largely at the commencement of the fattening, but if used extensively at the latter stage, the pork is not so saleable. Instead of maize a small quantity of bean-meal, or even better still, pea-meal, may be given with great advantage. Upon this the older pigs will thrive well, and the pork prove firm and sweet in flavour. Oatmeal will generally be found too expensive for pig-feeding. It may, however, be profitably used if the pigs are required to be made ripe at an early age, and exceptionally high quality of London porket-pig desired. The use of some condiment with fattening pigs of a restless disposition will be found of great benefit.

Condimental Food for Pigs.—Some object to the use of condimental food for pigs; but the experience of others is that for fattening-pigs, and for pigs that are newly weaned, some good well-manufactured stimulating food is of very great benefit, and is withal most profitable.

Cooked Food for Pigs.—There has been considerable discussion as to whether or not the cooking or steaming of meal as food for pigs is an advantage. Some writers on pig management strongly recommend the practice; but Mr Sanders Spencer states that his experience is decidedly against it. He has given it fair trials, and in every case where the experiment has been fairly and thoroughly carried out, it has been found unprofitable to cook or steam the meal for the pigs. In very cold weather it is advisable to mix the meal with tepid water, so that the food is given to the pigs at about the temperature of new milk. But a better plan even than this is to feed the pigs on dry meal, and to give the water to them in a separate trough. The pigs may be much longer in eating their food in this way, but it will be more thoroughly masticated and mixed with saliva, so that it is more fully digested; and the pigs will then only consume as much water as nature and the weather render needful. There is certainly no need to warm the food in summer; but in winter there is an undoubted benefit in having the food warmed.

Experiments on this question have also been carefully carried out at different agricultural colleges in the United States of America, and in almost every case it was proved that the cooking of the food resulted in a considerable loss.

Upon many farms potatoes form a large part of the food of pigs. The potatoes should be steamed or boiled.

Kitchen "Slops" for Pigs.—The "slops" of the kitchen are turned to good purpose as food for swine; but great care should be taken not to give pigs any liquid in which salt meat has been boiled or to which soda has been added. We have heard of several cases of death amongst pigs owing to their having been fed on such "slops" or boilings. The safest system to use house or hotel slops is to steam it, let it cool, and remove the fat which rises to the surface. The soup will in this form be far more valuable for pig-keeping, especially for young pigs. The "pig's-pail" should always be at hand to receive food-refuse from the kitchen.

Skim-milk, buttermilk, and whey are extensively used as food for pigs. These, of course, do not require cooking.

Feeding Old Pigs Unprofitable.—The fattening of old boars is, as a rule, unprofitable. One cannot afford to convert good food into pork which sells at from 1½d. to 3d. per lb., and even this only when not made very fat. The importation of low-priced foreign meat, and the great reduction in the price of lard, have rendered the manufacture of inferior, or very fat, meat a losing game. And a word of caution here may not be out of place as to the making of the bacon pigs too heavy and too fat. The well-fed, meaty pigs of 160 lb. deadweight will realise much more per lb. than can ever be obtained for the overfat pig of double the weight.

Green Food for Pigs.—Many pig-keepers seem to forget that the pig is naturally a graminivorous animal, and that in a state of nature it lives for a great portion of the year on grass, or the roots of certain plants, which it unearths by the use of its long snout; whilst its

chief food during the remainder of the season consists of beech-mast, acorns, chestnuts, or similar tree-seeds. Those who are generally most successful in the feeding of our domesticated animals are those who study most carefully the natural habits of the animals in their charge.

To make pig-feeding a complete success, it is imperative that a certain amount of green food should be supplied to those pigs which are confined in close quarters. It does not appear to matter much what this vegetable food consists of, whether it be grass, clover, lucerne, beet, mangels, swedes, turnips, cabbages, or kohl-rabi. All seem to have a beneficial effect on the health and progress of the pigs; whilst great numbers of pigs are fattened on cooked potatoes, and a little meal stirred with buttermilk or whey.

Pigs which are not allowed their liberty should also have an occasional supply of small coal, cinders, or even a lump of earth or mould. This will greatly tend to keep the pigs in health, and cause them to settle and thrive much better.

Exercise for Feeding-pigs.—It is sometimes found necessary to allow highly bred pigs a certain amount of exercise during the short time they are shut up in close quarters at the latter part of the fattening period. This difficulty, if it may be so termed, is not often experienced with the common-bred pig, whose spirit of unrest forces it to take a sufficient amount of exercise to keep the various organs of the body in good working order, and for the formation of that lean meat and muscle which is the natural result of a free use of the locomotive powers.

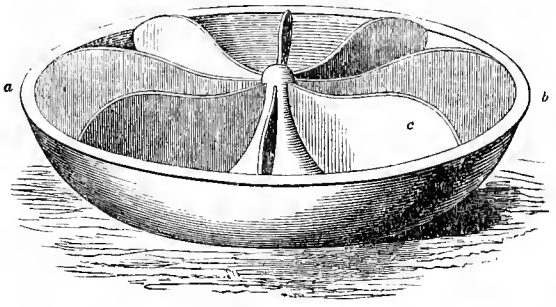


Fig. 713.—*Ring pigs' trough, to stand in a court.*
a b Hollow hemispherical trough, 30 inches diameter.
c Eight subdivisions within it, 9 inches high, converging and meeting at a central pillar.

Keep Pigs Clean. — Pigs are accused of dirty habits, but the fact is otherwise. The accusation really applies more to their caretakers, who oblige them to be dirty, than to the animals themselves. When constrained to lie amongst dirt, and eat food fit only for the dunghill, and dealt out with a grudging hand, they can be in no other than a dirty state. Let them have room, choice of clean litter, and plenty of food, and they will keep their litter clean, place their droppings in one corner of the court, and preserve their bodies in a wholesome state. The pig-house or pig-yard should be cleaned as regularly as the cow-house, and kept in a fresh wholesome condition.

It is the duty of the cattle-man to supply the store-pigs with food, and clean out their court-yard; and this part of his duty should be conducted with as much regularity as feeding the cattle. Whatever food or drink is obtained from the farmhouse is usually brought to their court by the dairymaid.

Pigs in Cattle-courts.—Pigs often get the liberty of the large courts, amongst the cattle, where they make their bed in the open court when the weather is mild, and in the shed when cold. Though thus left at liberty, they should not be neglected of food, as is too often the case. They should be fed regularly, and in addition to other food many give them sliced turnips in troughs. Pigs, when not supplied with a sufficiency

of food, will leap into the cattle-troughs and help themselves to turnips; but this dirty practice should not be tolerated, and it can arise only from their keeper neglecting to give them food.

A convenient pigs' trough, adapted for standing in the middle of a court, is represented in fig. 713. The divisions have a convexity on the upper edge, to prevent food being dashed from one compartment into the other. This trough stands upon the top of the litter, is not easily overturned—the cattle cannot hurt themselves upon it, while it is easily pushed about to the most convenient spot.

Rest for Feeding-pigs.—When pigs are fattening, they lie and rest and sleep a great deal, no other creature showing "love of ease" so strongly in all their doings; and, in truth, it is this indolence which is the best sign of their thriving condition. The opposite effects of activity and indolence on the condition of animals are thus graphically contrasted by Liebig. "Excess of carbon," says he, "in the form of fat, is never seen in the Bedouin or in the Arab of the desert, who exhibits with pride to the traveller his lean, muscular, sinewy limbs, altogether free from fat. But in prisons and jails it appears as a puffiness in the inmates, fed as they are on a poor and scanty diet; it appears in the sedentary females of oriental countries; and, finally, it is produced under the well-known conditions of the fattening of domestic animals;"[1] and amongst these last the pig may be instanced as the most illustrative.

Bedding for Pigs.—Wheat-straw is best suited for this, especially for the breeding-sow and her litter of young ones. In the cattle-courts, the pigs, of course, make litter of whatever is used for the cattle.

Nomenclature of Pigs.

The denominations of pigs are the following: When new-born, they are called *sucking pigs*, *piglings*, *piglets*, or simply *pigs;* and the male is a *boar pig*, the female *sow pig*, *hilt*, *elt*, *yilt*, *yelt*, or *gilt*. A castrated male, after it is weaned, is a *shot* or *hog*. Hog is the name mostly used by naturalists, and very frequently by writers on agriculture; but to avoid confusion with the name given to young sheep (hogg), it is convenient to use the terms pig and swine for the sake of distinction. The term *hog* is derived from a Hebrew noun signifying "to have narrow eyes," a feature which is characteristic of the pig. A spayed female is a *cut sow pig* or *gelt*. As long as both sorts of cut pigs are fat and young, they are *porkers*, *porklings*, or *London porket-pigs*. A female that has not been spayed, and before it bears young, is an *open sow* or *hilt*, *elt*, *yilt*, *yelt*, or *gilt;* and an entire male, after being weaned, is always a *boar* or *brawn*. A cut boar is a *brawner*. A female that has taken the boar is said to be *served* or *lined;* when bearing young she is an *in-pig* or *brood-sow;* and when she has brought forth pigs she has *littered* or *farrowed*, and her family of pigs at one birth form a *litter* or *farrow* of pigs.

THE PRINCIPLES OF STOCK-BREEDING.

The breeding of farm live stock is pursued with varying degrees of method or with no method at all. Far too many still mate their stock in a haphazard manner, availing themselves of the cheapest sire within reach, and practically leaving everything to chance. It is amazing that, at this time of day, there should be this lack of care in the breeding of stock, for to all who keep their eyes open the advantages obtained by giving due regard to the underlying principles of systematic stock-breeding must be clearly apparent.

Few men have risen to recognition as great breeders. The essential gifts and opportunities are not widely spread. But while there may not be many who

[1] Liebig's *Ani. Chem.*, 89.

can attain fame as breeders, it is quite within the reach even of men of average intelligence to accomplish good work in the production of improved farm stock if only they will give careful heed to plain lessons taught by the experience of others. To set forth some of these lessons clearly, and in as few words as possible, is the object of these notes.

Heredity.

The subject of heredity in animal and plant life has engaged the minds of many of the ablest naturalists and scientists who have ever lived, and yet some of its problems still await solution. Enough, however, has been made known regarding the laws of heredity in animals to afford valuable guidance to the intelligent breeder of farm live stock. In the old familiar saying that "like produces like," there is a simple interpretation of hereditary force in plants and animals. This "hereditary force" may be for good or it may be for evil, according to the character of the parental stock. The object of the breeder is to select as parents, stock or plants which he has reason to believe are likely to possess hereditary tendencies in the direction of the characters desired in the produce.

The universality of its application is a valuable property in hereditary force. It is not merely in conformation and outward appearance generally that heredity makes its influence felt, although it is in these features that its effects are most familiar to casual observers. The influence of heredity applies to the physiological, pathological, and other conditions of animals—to every one, indeed, of the parts and properties in animals which the breeder desires to develop or control for the good of mankind. Thus, whatever may be the particular object of the breeder, the careful study of the mysteries of heredity is to him a matter of the highest importance.

Over and over again it has been found in experience that by the skilful manipulation of hereditary forces possessed by individual strains or families, or even by individual animals within families, certain features can be "bred out" and others developed if not actually created. Unpopular colours in breeds of horses and cattle have been obliterated or lessened in the frequency of their occurrence. Tendencies to constitutional weakness or certain forms of disease in particular families may be partially or entirely removed. In like manner, desirable qualities or characteristics can be fixed and strengthened, and thus through the influence of heredity transmitted to the family or tribe generally.

For the breeder it is well to bear in mind that, as already pointed out, heredity applies to the psychological as well as to the physiological characters. Of this fact there is proof in the transmission of the wonderful instincts possessed by some animals. Not infrequently it has been found that vicious tempers can be weakened in certain strains, just as in other strains different characters and instincts have been developed.

It is equally important for breeders to keep in view the significant fact that pathological conditions are likewise affected by hereditary forces, and that unless care be exercised, strains of stock hitherto quite healthy may become tainted with or rendered predisposed to diseases the occurrence of which had originally been merely accidental. The safe course is to avoid breeding from animals known to be either actually affected by, or to be predisposed to, disease of any kind.

Variations in Breeding Results.

Fundamental and powerful as are the laws of heredity in the raising of both plants and animals, it is well known that they are by no means absolute or unfailing in their application. To the surprise of the breeder—it may be to his gratification or it may be to his disappointment—they are now and again found to have been quite unavailing, to have been for the moment pushed aside, as it were, by some other mysterious force, which displayed its influence in the production of a "variation" or a "sport," as it is differently called. Sometimes this "variation" may be merely a "reversion" to a type at one time characteristic of the ancestors on either side or both. Just as likely it may be a true "sport" displaying features entirely strange to the family and the tribe. It accords with

the experience of breeders to say that the tendency to variation is contributed to by change of environment—by change in habits, in the uses to which animals are put, in the climatic conditions under which they live, and, in particular, in the methods of feeding, which are nowadays much more of a forcing character than in olden times. It is probably true that the more highly artificial the conditions of animals have become, the greater is the liability to unexpected "variations" in type. The tendency to variation is also increased by indiscriminate crossing different strains.

But while these no doubt are the prevailing views regarding unlooked-for results in breeding, there are those who believe that their occurrences are just as surely the product of laws of nature as are the typical progeny of related parents. To give forth variety, it is claimed, is an inherent power in nature, a provision not really antithetical but rather beneficently complementary to those other natural laws which lead men to look for like begetting like as the normal condition of things.

"All the organs and tissues of which an individual is compounded possess the power of independent variation. Every single cell may possess this power. . . . Every variation, when once it has started, may be looked upon as a structure capable of independent variations in an almost infinite number of directions, regressive and progressive. . . . Two forces are constantly at work in nature—Natural Selection and Reversion. The former causes progressive evolution, the latter regressive evolution. They are opposed, but one would be inadequate without the other. They are warring forces, but their resultant is a near approach to perfection."[1]

But be the causes what they may, it is well that "variations" do occur with moderate frequency. They have played a useful part in the development of stock-breeding. Indeed, it is by the skilful cultivation of adventitious "variations" that some of the most valuable improvements in British live stock have been brought about.

Transmission of Acquired Characters.

There has been much discussion and sharp differences of opinion as to the extent to which abnormal and acquired characters may be transmitted to future generations. Prior to the 'eighties of the nineteenth century it was the belief of many eminent biologists that "sporting variations," as well as modifications induced by sustained treatment, or arising as the result of accident, might be so "bred into" strains of stock as to ensure transmission to future generations like hereditary characters in a family current. Herbert Spencer wrote that "change of function produces change of structure. It is a tenable hypothesis that changes of structure so produced are inherited." That doctrine, however, was to a large extent set aside by the publication of Weismann's elaboration of Galton's Germ Plasm theory of heredity,[2] which in course of time claimed the support of most of the leading biologists.

It was declared by Weismann that the germ cells concerned in reproduction are distinct from, and quite independent of, the body or soma cells; that while the germ or reproductive cells are "housed" and nourished in the body, they do not absorb transmissible characters from the body, but reproduce only those characters conveyed to the germ cells from the two parents in the act of fertilisation.

The continuity of the germ plasm may be admitted, but it does not necessarily follow that it is not subject to any modification by its successive hosts in its progress from generation to generation. Indeed, it is admitted by some of the foremost living biologists that the vitality and stamina of the germ cells are affected by the nourishing body for the time being, and with that admitted, and having also in mind the acknowledged inherent power of "independent variation" possessed by "all the organs and tissues of which an animal is compounded" (Reid), it is permissible for the breeder to assume that he is not so absolutely devoid of the power of initiative as a strict interpretation of the Weismann doctrine would suggest.

[1] *The Principles of Heredity.* By G. Archdall Reid.

[2] *The Germ Plasm: A Theory of Heredity.* Walter Scott, Ltd., London.

Is there not reason to believe that the inherent power and tendency in organs and tissues to give out variety may be usefully stimulated by "the play of forces from the environment"? How far the form or tendency of the "variation" may be guided by the breeder is matter of doubt. That he has exercised substantial guiding influence in the progressive evolution of the cultivated races of stock does not admit of denial, attested as it is by living testimony that is unmistakable.

"The discriminating sense of the foxhound as he distinguishes on the moist earth the fresh track of the fox, or of the bird-dog that is insensible to the fox tracks, but becomes immediately excited in the proximity of birds, is an interesting phenomenon. The Scotch collie seems, as a result of long-continued breeding and training, instinctively to know how to assist in the handling of domestic animals, but is utterly foolish in its attempts to catch rats. Most terriers, on the other hand, are tremendously in earnest in their frantic efforts to tear up wooden floors or undermine buildings for the sake of securing a rat, but as stock-dogs are utterly useless. The wonderful productive capacity of the modern dairy cow, producing ten thousand or even twenty thousand pounds of milk in one year, and the transmitting of these qualities to her offspring, are recognised facts among dairymen. Families of horses have acquired speed at the trot and transmitted this quality with considerable certainty." [1]

There is no reason for breeders being in any way discouraged by the spread of the Weismann theories of heredity. Whatever the governing scientific principles may be, the fact remains that the useful features and properties of plants and animals are constantly undergoing important modification and development at the hand of man,—developments and modifications many of them indubitably influenced by the play of environment.

Other Breeding Problems.

Telegony. — Amongst many knotty problems which have troubled breeders of high-bred stock, what is known as Telegony demands mention. It is believed by not a few breeders that occasionally a calf, a foal, a pup, or other animal resembles or "takes after" neither its mother nor its own sire, but another sire mated with its mother at some former time. By Darwin it was stated that "the influence of the first male by which a female produces young may frequently be seen in her future offspring by different sires," and numerous instances have been mentioned which it was believed supported the idea that an early sire had so "infected" a female as to influence her future progeny by other sires. In later times the belief in "telegony" has lost ground, and few breeders now pay any attention to it. Professor Cossar Ewart, who has conducted many experiments on the subject, gives it as his opinion that the doctrine is not well founded. Be the facts as they may, the wise course to pursue in the breeding of valuable stock is to avoid even the occasional use of any sire whose "infectious influence" could be to any extent or in any way detrimental to the strain.

Mental Impression. — Another disputed question is the part which mental impression on the part of the dam is supposed to play in determining the colour or other character of the progeny. Ever since Jacob peeled wands and stuck them up before Laban's stock and his own, in order to increase the proportion of spotted and speckled produce which fell to him, this doctrine has continued to receive some little attention in stock-breeding. It has been the practice of certain breeders of black cattle to avoid keeping light-coloured animals within sight of their black cows when the latter are conceiving or are in the early days of pregnancy. At the same time, it is generally held by scientists and naturalists that mental impression is not a factor of any significance in the breeding of stock. It is of course known that unborn young may be seriously affected by extreme nervous shock sustained by the mother, and it is desirable that pregnant animals should be as far as possible protected from the risk of such occurrences.

Controlling Sex. — Much attention

[1] F. B. Mumford in *Cyclopædia of American Agriculture*. The Macmillan Co., London.

has from time to time been given to the controlling of sex in stock. Various theories have been propounded. It has been held by some that if service takes place early in heat the produce will be a female, if late in heat, a male. Another theory is that ova are alternately male and female, and that if an animal has produced a male, and a male is wanted again, the female should be served not in her first but in her second heat. Yet another idea is that the sex of the produce will correspond to that of the parent that preponderates in stamina and general vigour at the time of mating. Some, again, believe that sex can be regulated by food. Little success has attended the prosecution of any of these or of other theories that have been advanced for the same purpose. Fortunately, it would seem that the controlling of the sex is one of nature's secrets not to be brought within the ken of man.

SYSTEMS OF BREEDING.

Four main systems are pursued in the breeding of live stock. These are generally known as (1) Cross-breeding, (2) Grading, (3) Line-breeding, and (4) In-and-in-breeding.

Cross-Breeding.

This term is applied to breeding from animals of different species, breeds, or varieties—to a mixing of strains as distinguished from systems of breeding in which the main purpose is the concentration of breed or tribal currents. Sometimes the word crossing is applied also to the interbreeding of different families of the same breed, but this is not in accordance with the general understanding of the term.

The general experience of breeders is that judicious crossing has a stimulating effect on the more useful properties of animals. There is often an increase in size, in vigour of constitution, in fecundity, and in rate of maturing, as well as in improved fattening properties in meat-producing stock. It has thus come about that by cross-breeding the rent-paying qualities of farm live stock have been enhanced substantially.

But there are some effects of crossing to which breeders must give careful heed. Crossing, as already stated, has a tendency to break up family currents, and unless great care is exercised in the introduction of an out-cross into pure or well-established strains, much injury may be done to their breeding properties, particularly in respect to regularity of type. As already indicated, the tendency to "variation" is increased by cross-breeding.

In the selecting of animals for cross-breeding, there is ample room for the exercise of care and judgment. Care is required in choosing varieties or breeds that blend well together, and also in selecting sires well adapted for mating with the females in the stock. The most general practice is to use on mixed-bred females pure-bred sires of well-established character. It is in this way that the quality and value of the produce can be most speedily and economically improved and maintained.

The first cross between two pure breeds is usually the most successful of all kinds of crosses. It is not very often that first or subsequent crosses give satisfactory results when thoughtlessly bred together. There would, as a rule, in these cases seem to be such a breaking up of the forces of heredity that the character of the progeny becomes a mere matter of chance. Family currents of any considerable strength cannot be established by indiscriminate breeding such as this.

Students of Mendel's laws of heredity are of opinion that a full acquaintance with the operation of these laws would enable breeders to make use of the principle of cross-breeding in the improvement of their pure-bred stock without incurring the risks hitherto believed to be involved. To this important question fuller reference will be made presently.

Grading.

This is an American term which very aptly describes the practice of raising improved races of stock by mating pure-bred sires with females of mixed breeding and secondary or inferior character. Pure-bred sires from the same breeds respectively continue to be put to the progeny for a greater or lesser number of generations, and in this way there may be established different types of animals of high utility, and possessed of

fairly reliable breeding properties. In the building up of several of the existing pure-bred races this method has been largely pursued.

Line-Breeding.

This term implies the mating of animals that are related to each other. It differs from "in-and-in-breeding" in that the mating is not restricted to near relations, but, as a rule, applies rather to animals not closely related though mostly claiming some measure of blood-relation with the same family. The tendency of line-breeding is to concentrate and strengthen hereditary force. Here lies its advantage over crossing, the influence of which is in the opposite direction. It is further claimed for line-breeding that it is safer than in-and-in-breeding, in that it is not so liable as the latter is alleged to be to lead to an impairing of the fecundity and constitutional vigour of families. In the vast majority of pure-bred stocks line-breeding is pursued to a lesser or greater extent, and it is unquestionable that the judicious use of this method has done much to establish the high character of British pure-bred stock, alike in regard to stability of type and practical utility.

In-and-In-Breeding.

This system is the mating of closely related animals. It embraces the breeding together of animals of various degrees of relationship, no very distinct line of demarcation being drawn between it and line-breeding.

Over the merits and demerits of in-and-in-breeding there has been endless discussion. It is undeniable that its power for good is great. It is the surest and speediest of all methods for establishing character and fixing family type. The forces of heredity are more intensely concentrated by this system than by any other. As would be expected, therefore, in-and-in-breeding has been a predominating influence in the building up of most of our many distinctive breeds and tribes of live stock.

On the other hand, it is known that persistent close in-and-in-breeding tends to loss of size, fecundity, and constitutional vigour. Weaknesses and other defects are just as surely intensified by it as are good points, and unless conducted with consummate skill and care it is not likely to be long followed with impunity.

The Value of In-bred Families.

In discussing the systems of breeding pursued amongst herds of Aberdeen-Angus cattle, the authors of the History of that breed expressed the opinion that it was very desirable more attention should be given to the building up of distinct well-defined families of as pure line-breeding as might be found practicable. "It seems to us," they continued (and the remarks have a general application to all breeds), "that it would be well for the interests of the breed if there existed several herds or strains which could be regarded as refined and reliable fountains of that mysteriously beneficial influence which may be generated by skilfully concentrating and assimilating the ever-present forces of heredity. Without entering upon a discussion of the question of in-and-in-breeding, we may remark that we believe it to be a most powerful agent either for good or evil. In competent hands it is perhaps the surest and shortest pathway to the highest pinnacle of a breeder's success. Unwisely employed, it becomes simply the broad road to ruin. We would not, therefore, desire that in-and-in-breeding should be pursued by the general body of breeders. We would, however, rejoice to see a few of those best able, intellectually and financially, to undertake the work, following the example of Thomas Bates, the Booths, and other noted Shorthorn breeders, and establishing distinct line-bred families. We should like to see a few families reared in such a way that they would not only be uniform in shape and character, but would also be possessed of one strong, unbroken, unadulterated, unvarying family current. We believe in the doctrine that 'like begets like'; but if we breed from composite animals—animals containing several conflicting family currents, perhaps the living influence of dead ancestors—we can have little confidence in the result. We cannot know which *likeness* may be produced—that of the immediate or of more remote ancestors. Practical experience and scientific

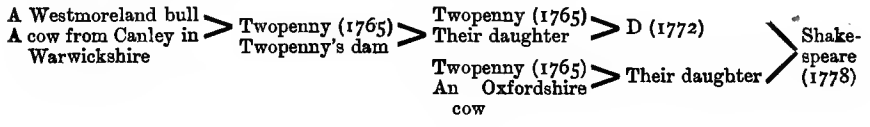
reasoning both teach that no animal is so likely to reproduce an exact copy of itself as one that has been in-bred, or, in other words, one that contains one dominant, all-prevailing family current. We therefore think that the existence of a few well-defined in-bred families of really high individual merit would help greatly to maintain, and even still further improve, the high character of the breed generally. These families would be, as it were, strong springs of rich, pure blood, from which fresh draughts might be drawn from time to time for the refining and ameliorating of mixed herds."[1]

In-and-In-Breeding in Pioneer Herds.

To Professor James Wilson, Royal College of Science, Dublin, we are indebted for the notes which follow on the use which pioneer breeders of cattle made of in-and-in breeding in the establishing of their herds. It is a striking and remarkable fact, he says, that the operations of our greatest stock-breeders have always been accompanied by the same three phenomena in every case. The breeders themselves have been unparalleled judges; they took enormous pains to secure the highest quality of stock for their herds, and, having done so, they bred from remarkably close relations. There is also strong presumptive evidence that they have all been masters of the art of culling or elimination. And these phenomena were to be observed, not only among the pioneers to whom breeds were indebted for their start in life, but also among subsequent workers.

It is well known how Bakewell, in the middle of the eighteenth century, scoured the country, going as far afield as Westmorland and Warwickshire for cattle, Yorkshire and Lincoln for sheep, and Holland for horses. Then, having secured the best stock, and afterward finding none so good as the progeny which he had bred himself, he put his own stock to his own for successive generations.

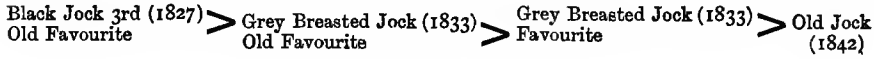
The following diagram showing the pedigree of Bakewell's bulls "Twopenny" and "D," and of "D's" son "Shakespeare," bred by Mr Fowler, of Rollright, in Oxfordshire, will show Bakewell's method:—[2]



Similarly we know how the brothers Colling and Hugh Watson, with far less trouble, became possessed of the best cattle in Durham and Forfarshire respectively, how they mated their cattle as Bakewell had mated his, and how from their efforts the Shorthorn and the Aberdeen-Angus breeds of cattle were set upon the track which they have since pursued. That these great breeders should have followed the example of Bakewell was not astonishing, since one of the Collings (Charles) had visited Bakewell, and Watson was intimately acquainted with the Collings' successors. A Colling and a Watson pedigree will suffice to show their methods:—

A Colling Shorthorn Pedigree.

A Watson Aberdeen-Angus Pedigree.

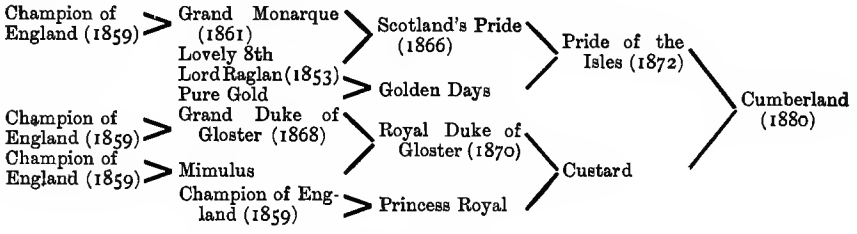


[1] *History of Polled Aberdeen-Angus Cattle.* By James Macdonald and James Sinclair. Vinton, London.

[2] The figures attached to bulls in these diagrams indicate, approximately in the case of pre-herd-book animals, the dates of their birth.

If the latter of these pedigrees were traced still farther back it would still show close breeding, although less close than in the diagram.

The greatest of all the non-pioneer breeders, and perhaps the breeder whose work is of most educative value, was Amos Cruickshank, who in 1837, about fifty years after their type was first established, began to breed Shorthorns. Of all the great breeders, Bakewell alone perhaps excepted, Cruickshank took the greatest trouble to secure for his herd the kind of stock that approached his ideals and to reject those that did not. Indeed, the story is almost pathetic. For more than twenty years he travelled up and down the country, securing occasionally a cow or a bull good enough in character and pedigree, but especially in character, to add to his herd. These were put upon trial, as it were, and retained or discarded according to the stock they produced. But in 1859 Cruickshank had the fortune to secure a bull, "Lancaster Comet," which produced him a bull-calf, "Champion of England," which approached so near to his ideals that only one or two more bulls were bought in. Then he used "Champion of England," "his sons, grandsons, and great-grandsons, until at the time the herd was sold (in 1889) every pedigree was saturated with 'Champion of England' blood." The following diagraphic pedigree of Cruickshank's great bull "Cumberland" will show this :—



Between the intense in-breeding of Bakewell and Hugh Watson and the milder form pursued by Amos Cruickshank there is a large gap; between Cruickshank's system of mating and that of the ordinary breeder of high-class stock there is another gap which is often by no means large. In many cases, indeed, because of the incomplete manner in which pedigrees are usually set forth, animals are much more closely related than is generally supposed.

MENDEL'S LAWS IN STOCK-BREEDING.

It is believed by many that a new era is to be opened up for breeders of both plants and animals by the application of what are known as Mendel's Laws of Heredity. In vol. ii. (pp. 110-114) information is given as to experiments with these laws in the improvement of grain. That information is transcribed from a paper by Professors Wood and Punnet of Cambridge in the *Transactions of the Highland and Agricultural Society of Scotland* for 1908.

Mendel and his Work.

From the paper just mentioned the following note is taken regarding Mendel and his work: "We begin to understand many of the mysterious things that happen when crosses are made among animals and plants — why a character often skips a generation, why the type is often broken to give rise to new forms, and what is the meaning of reversion. The foundations of this knowledge were securely laid by Gregor Mendel, an Austrian monk, in the garden of the monastery of which he afterwards became the head. Mendel has (1908) been dead for nearly thirty years, and it was as long ago as 1865 that his discovery was first given to the world. But his ideas were in advance of his time; they excited little interest and were soon forgotten. It was not until 1900 that his paper on the pea was unearthed, and scientific men began to realise what a far-reaching discovery this was

that Mendel had made so many years ago. As a young man he had studied the natural sciences in Vienna, and had become interested in the problems of heredity. On returning to his monastery he devoted much of his leisure to carefully investigating the manner in which characters are transmitted in the common pea. From the results of his experiments he deduced certain principles which he found to hold for all the various characters he studied. During the past few years these principles have been confirmed and extended, not only for many plants but for animals as well."[1]

Mendelism Explained.

The following notes on the application of Mendel's laws to the breeding of live stock are from the pen of Professor James Wilson, Royal College of Science, Dublin :—

In explaining Mendelism we shall take our examples chiefly from cattle, because more is known in regard to them than in regard to other farm stock.

When red cattle are bred together their progeny are red, and when white cattle are bred together their progeny are white. But when red cattle are crossed with white their progeny are roan; and

(*a*) When these roan crosses are bred together their progeny are 25 per cent red, 50 per cent roan, and 25 per cent white;

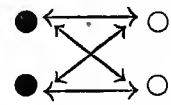
(*b*) When they are crossed back again with red cattle their progeny are 50 per cent red and 50 per cent roan; and

(*c*) When they are crossed back again with white cattle their progeny are 50 per cent roan and 50 per cent white.

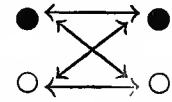
A similar series of phenomena occurs when absolutely pure-bred black cattle are crossed with white, excepting that in this case the crosses are blue roans instead of red.

Mendel's conception[2] which explains these phenomena is that an animal, at its very start, receives from its parents the determinants of its future characteristics in respect of colour, size, length of limb, length of horn, presence or absence of horns, mental powers, and so on; that these determinants are made up of two halves; and that they are passed on to the next generation through the sperms of the male and the ova of the female. But through each parent passing on a determinant and the young requiring only one, a half of each parental determinant is dropped in the melting-pot of fertilisation, and the young starts off with one only, the two halves of which are derived one from each parent.

This can be made clear by a diagram. A red Shorthorn carries a determinant for redness which may be represented by two small filled circles, thus ●●; a white Shorthorn carries a determinant for whiteness which may be represented by two small unfilled circles, thus ○○. When a red Shorthorn is bred to a white, either of the two halves of the red determinant may meet either of the two halves of the white, thus :—



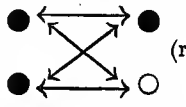
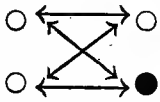
and the young starts off with a determinant which is half white, half red, thus ●○; and, as we know, its colour is roan, a mixture of white and red.

When two roan animals are bred together, either half determinant of each parent may meet with either half of the other, thus  ; and there are four chances: one that a red will meet a red, two that a red will meet a white, and one that a white will meet a white. Thus, over a sufficient number of calves from roan parents 25 per cent are red, 50 per cent roan, and 25 per cent white.

When a roan is bred back to a red or to a white, the chances are that half the young will be roan and the other half

[1] *Trans. High. and Agric. Soc. of Scotland*, 1908.

[2] Mendel worked with plants, but his theories are applicable to animals also.

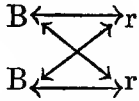
red in the one case, and half the number roan and the other half white in the other case, thus:  (red by roan) gives either (red) or (roan), and  (white by roan) gives either (white) or (roan).

In cases like the above, although it is possible eventually to change the colour of a breed from one colour to another by the continued infusion of that other colour, it is not possible to change the shade. There is no chance of gradually turning a white breed black by breeding each successive generation of a darker and darker shade.

But there are cases in which the first crosses are not intermediates with regard to one or more determinants, but are all like one of the parents. This happens, for instance, when absolutely pure black breeds are bred with red breeds. The first crosses are all black; and when they are bred together some of their progeny are black and others red; while when they are bred back to either parent race their progeny are all black in the one case, and some are black and some red in the other. Mendel's explanation is that these first crosses are not pure but impure blacks: they carry both determinants, but the black has its way and dominates or hides the red.

Let us put it graphically, using letters instead of circles, with capitals for the dominant and small letters for the hidden or recessive[1] colour.

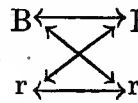
Black crossed by red gives an impure black cross, thus:—

 gives only $\frac{B}{r}$,

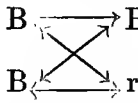
[1] Mendel called the one kind "dominant," the other "recessive." "Subdued" would be a better word than "recessive."

in which the animal carries both determinants, but black hides the red.

When these crosses are bred together, 75 per cent of their progeny are black and 25 per cent are red; but of the black ones only one in three is pure black, the other two being impure, thus:—

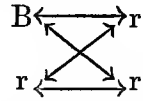
In  there is one chance in four of the young being $\frac{B}{B}$, two chances of them being $\frac{B}{r}$, and one chance of them being $\frac{r}{r}$; and those that are $\frac{B}{r}$ are impure black like their parents.

When these crosses are crossed back to pure black cattle all their progeny are black, but only half of them are pure, the other half being impure blacks, thus:—

 gives only $\frac{B}{B}$ and $\frac{B}{r}$

in equal proportions.

But when these same crosses are bred back again to red cattle, half the young are impure blacks and the other half reds, thus:—

 gives only $\frac{B}{r}$ and $\frac{r}{r}$

in equal proportions.

Because of these phenomena it is possible, by crossing black and red breeds, to turn the red breed black and the black breed red, the latter being easier.

It will be noticed that the red cattle produced from the above crosses are always pure. Animals carrying recessive characters are always pure for that character. Thus to turn a black breed red it is only necessary to cross them with a red breed, breed from the first crosses, and keep the red calves they produce. If it were too expensive to sacrifice all the black calves, then by always putting red ones

to black ones, the black ones would gradually become so few that their sacrifice would be comparatively inexpensive. The following table shows the percentage of both colours that might be expected if this method were followed :—

	Black calves. per cent.	Red calves. per cent.
(1) 100 absolutely pure black cows crossed by red bulls would give . .	100	0
(2) 100 black first cross cows, *e.g.*, crossed by first crosses, would give .	75	25
(3) 100 black (75) and red (25) of the second cross generation crossed by red bulls would give	50	50
(4) 100 cows of the third generation crossed by red bulls would give .	25	75
(5) 100 cows of the fourth generation crossed by red bulls would give .	12½	87½
(6) 100 cows of the fifth generation crossed by red bulls would give . .	6¼	93¾

and so on.

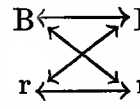
And this process has actually been employed to turn the old black Highland breed red. The result is masked by the presence of other colours—brindle, dun, and yellow,—but when these other colours are eliminated, a breed that less than a hundred years ago was nearly all black is now nearly all red.

In the second volume of the *Highland Herd-Book*—the first in which cows and their progeny are entered—(published in 1887), the proportion of red calves registered as compared with black ones was 1.63 to 1, whereas in the fifteenth volume the proportion is as 7.8 to 1.

The process of turning a red breed black—that is, from a recessive to a dominant colour—is only slightly different, the added difficulty being that, unlike the red ones, the black cattle are not all pure for their own colour, and thus, although the continued use of the black colour will eventually eliminate the red, the process may take longer, and will be accompanied by the appearance of red calves—"reversions,"—the number of which, however, will gradually decrease. But the process could be hastened by testing the black cattle for purity and making use of those that come through the test: which is to breed the black ones to red ones. Those whose calves are all black are themselves pure for blackness.

And just as the Highland breed is an example of turning a black breed into a red one, so there are other breeds which, if they are not examples of turning red into black, can be quoted as examples which show the intrusion of red and the difficulty of its elimination, unless systematically taken in hand.

The Aberdeen-Angus is one of the breeds in question. Like all the other black breeds, it absorbed some red blood at some time in the past, and a red calf still appears occasionally. These red calves are really "reversions," and they appear in this way: The intrusion of the red cattle produced a number of impure black cattle $\binom{B}{r}$, and although these have grown gradually fewer, there are still some in the breed, and when two meet their progeny have one chance in four of being red, thus :—



gives B B r and r
B, r, B, r.

A very famous Aberdeen-Angus cow completely lost her character by giving birth to a red calf. It will be seen from the above that the bull was equally to blame.

Besides the above cases of colour, a few more instances in which a breed or a race of cattle has been similarly affected by another might be quoted :—

(*a*) The long-legged, light-bodied, black Kerry cattle were crossed a century or more ago by short-legged, stout-bodied, red cattle of Devon type from the south of England, and there was produced the short-legged, stout-bodied Dexter Kerry, which is sometimes red, but more often black, the breed not being fixed as yet for one colour or the other. This is a case of shortness of leg, stoutness of body, and blackness all being dominant.

(*b*) A number of white-faced and finch-backed cattle were brought to England from Holland and the neigh-

bouring countries in the seventeenth and eighteenth centuries, and through them these markings were handed on to many cattle in England, Scotland, and Ireland, and they still occasionally occur as "reversions." The Herefords still retain the white face, which is dominant over other face colours, and the Longhorns the finch-back.

(*c*) Hornlessness, which in all probability came to Britain from Scandinavia, and is now common to several breeds, is dominant to hornedness, and can be handed on to horned cattle. There are hornless Shorthorns and Herefords in America. By the reverse process horns could be put upon polled cattle.

(*d*) Nearly two thousand years ago the Romans brought cattle to Britain, whose long, wavy horns were handed on to many English and Scots cattle.

It is clear, therefore, that where a character is found dominant to another, either can be transferred from family to family and from breed to breed, and in this way a new variety can be produced. The importance of this will be realised if we mention a few pairs of characters which we should like to have under control, and which we should like to be able, as the case may be, to impart to or eliminate from our stock. The characters we will mention are such as there is hope to believe may be Mendelian, viz.:

High-milking and low-milking qualities.
A high and a low power of producing fat in milk.
Fatness and leanness.
Straight and tilted horns.
Black noses and white noses in cattle.
Short legs and long legs.
Hairy and non-hairy legs in cart-horses.
Long wool and short wool in sheep.
Stiff wool and soft wool.

And, to take only a single case, if much milk and fatness are found to be Mendelian characters, it will at once be possible to combine the two characters in any breed of cattle: not, however, in some breeds without crossing with others.

The light which is thrown upon the methods of various breeders by Mendelism is already possessed of considerable illuminative capacity, which will increase as our observations, which have been confined so far almost to colour alone, pass on to other less obvious but more important characteristics. Meantime, let us make use of the knowledge now at our command.

The extreme methods of breeders are crossing and in-breeding. It is well known that stock-breeders can usually tell what to expect when two breeds are crossed, but that when first crosses are bred together or to some strange breed their progeny are very irregular, some being like their parents, some like their grand-parents, others like breeds now extinct, others like no animal ever known. The explanation is that when breeds are mixed up the determinants for colour and other things are also mixed up, and shake themselves down in any possible manner. A good example may be taken from Highland cattle. Four races have gone to the making of this breed,—a black race, a red, a light dun, and a brown or *donn;* and through the interbreeding of these, five new hybrid colours have been produced—namely, yellow and dun and black brindle, red brindle and dun brindle; and if three brindle bulls—a black brindle, a red brindle, and a dun brindle—were put to a large herd of brindle cows, every one of all the nine colours would appear in their progeny.

And if this kind of thing happens with colours, and similar things may happen with other characteristics, we can readily understand why careful stock-breeders are so very chary of cross-bred animals. In-breeding, on the other hand, brings together fewer determinants, eliminates the unexpected, and produces a breed which is more and more regular in all its characteristics—those, at any rate, that are dominant and recessive—the longer it is persisted in. Most of our breeds of stock have been built up from mixed foundations, and it was only by in-breeding that regularity and some part of what is vaguely called "prepotency" was achieved.

In line-breeding, again, the phenomena usually attendant upon crossing are avoided, although steadiness to type is not got in this way as it is got by in-

breeding—a matter that is of less moment in a breed that has already been steadied by in-breeding.

These points could all be illustrated fully if only the work of breeders who are still alive, and of others recently deceased, could be referred to, but every stock-breeder knows how very tentatively and tenderly the greatest of his own colleagues proceed in the introduction of "fresh blood" or "out-crosses," and how very frequently, unless they can be graded up by being always mated to the breeder's own type, the descendants of these out-crosses have to be eliminated from the herd.

PERIODS OF GESTATION.

The periods over which the females of the various classes of live stock carry their young are as follows:—

Mare . . .	48 weeks.
Cow . . .	40 "
Ewe and goat .	21 "
Sow . . .	16 "
Bitch . . .	9 "

The egg of the goose hatches in 30 days, of the turkey, duck, and pea-fowl in 28 days, of the pheasant and partridge in 24 days, and of the barn-door fowl in 21 days.

POULTRY.

Poultry-rearing as a rural industry has not yet taken the position it ought to occupy in this country. In particular, as an adjunct to other branches of agriculture it should receive a great deal more attention than has hitherto been devoted to it. To realise that there is much room for extension in the raising of eggs and table poultry, one has but to look at the official returns showing the vast sums of money sent over the seas for eggs and table fowl to meet the demand in this country for these choice and popular articles of food.

In the belief that an extension in poultry-rearing is much to be desired amongst agriculturists of almost all classes, whether their holdings be small or large, it has been thought well that in this edition of *The Book of the Farm* the section dealing with Poultry should be entirely rewritten with that important object prominently in view. For this new matter the editor is indebted to Mr Alex. M. Prain, who has had much successful experience in the rearing of poultry.

New-laid Eggs.

A glance at the monthly and yearly returns of the imports of commodities for the food of the people will indicate that, especially in the production of new-laid eggs, there is room for great development in this country. For these there will always be a ready demand at prices far higher than can be offered for foreign eggs, which at the best cannot be placed in our markets under ten days' old—at which age, though they may be perfectly fresh, yet they cannot be regarded as *new-laid.*

A very considerable proportion of the imported eggs have been preserved in lime, and these are used for cooking and for confectionery purposes. With such an unlimited demand from our large cities, the British farmer has every advantage over his foreign rivals, and it should be his privilege to supply the demand for the top quality of new-laid eggs, leaving the foreigner to supply the second and third qualities if he likes. The benefit is a mutual one, shared equally by buyer and seller. The aim of poultry-rearers in this country should be to put a large supply of newly laid eggs on the market *all the year round.*

Table Poultry.

As with eggs so it is with fat poultry. But the average farmer has yet to learn that the surplus cockerels and old hens require to go through a process of fattening before being put on the market. The fattening is to a large extent in the

hands of a few large firms, who buy the young birds at from three to four months old, put them through a three weeks' process of fattening, during the latter half of which they are crammed, and then sell them at very high prices.

PURE BREEDS.

In the breeding of poultry, farmers as a rule seem to have very hazy notions. No definite system could possibly be traced from the appearance of an average flock of farm fowls, unless the mixing up of as many breeds as possible in the composition of the flock could be called a system. Considering that certain well-defined rules guide the breeding of other classes of farm stock, such as horses, cattle, and sheep, it is surprising that totally different ideas should prevail in regard to poultry. Apart from the breeding of exhibition stock, every owner of a flock of fowls should have a definite object to strive for,—either the production of the greatest possible value in eggs or the best table fowls.

Now, to mix up indiscriminately laying breeds and table breeds in one flock is to court failure in both purposes, for it is recognised by all authorities on poultry-rearing that mongrels are economically unprofitable. Seeing that there are now available so many pure breeds having certain characteristics clearly established, it is a matter for surprise as well as regret that mongrels are still so common.

Classification of Pure Breeds.—These pure breeds, which are the result of the most careful breeding and selection, may be divided into four main groups, as follows: (1) Laying Breeds, (2) Table Breeds, (3) General Purpose Breeds, and (4) Fancy Breeds.

Among the best known and the most useful in each section are—

Laying or Non-sitting.

Minorcas.	Anconas.
Leghorns.	Campines.
Andalusians.	Hamburgs.
Houdans.	Scotch Greys.

Table Breeds.

Dorkings.	Old English Game.
Indian Game.	Sussex.

General Purpose Fowls.

Orpingtons.	Faverolles.
Wyandottes.	Langshans.
Plymouth Rocks.	

Fancy Breeds.

Modern Game (some varieties).	Bantams.

Laying Varieties.

A short description of each of these breeds is given here, with a note of their main characteristics.

Minorcas.—There are two recognised varieties of the Minorca breed, the Black and the White, but the latter are very rarely seen. The breed is one of the Mediterranean family, believed to have been imported into this country from the island of Minorca. It has all along been a favourite, more especially in certain districts of England.

The plumage is beetle-green black, with brilliant red comb and wattles, and smooth white ear-lobes. The carriage should be sprightly and stylish, with nice long body carried on legs of medium length. For size and quality of eggs no breed can beat them, and, if kept from severe frost and cold winds, they will lay well all the year round except during the moulting period. It is a general characteristic of all the non-sitting or laying varieties that they will not lay well during winter in very exposed situations or in periods of severe frost—that is, of course, unless suitable shelter is provided for them.

The Minorca is justly regarded as one of the oldest and most reliable of all the breeds of poultry. Fig. 714 represents a Minorca cock, and fig. 715 a Minorca hen.

Leghorns.—The Leghorns are also of Mediterranean origin, and are now divided up into a great many sub-varieties. The best known of these are the Whites, Browns, Buffs, Duckwings, Piles, Cuckoos, Blacks, and Blues.

The Whites are the largest in body, but all have the same main points—namely, a very graceful body carriage, with bright, clean, yellow legs, and a very active foraging disposition, which makes them economical to feed and

easy to rear. All varieties are capital layers of good-sized white eggs. A White Leghorn cock is shown in fig. 716, and a White Leghorn hen in fig. 717.

Andalusians.—The Andalusians are another of the Mediterranean group. They are slate-blue in ground-colour, with a purple-black lacing round each feather in the hen, and the same colour on the neck, hackle, and back of the cock. The body is rather slim, with fairly long legs, and the head-points less fully developed than in either the Minorca or the Leghorn.

Houdans.—The Houdan is a French breed once very popular, but not so common now. It is of large size, broad and massive, mottled black-and-white plumage, and a full round head-crest. The legs are short, pale in colour, free from feathers, and carry a fifth toe.

Anconas.—This is a comparatively new variety. It has brilliant beetle-green plumage, each feather being tipped with white. In style it resembles closely some of the smaller Leghorn varieties, the hens being excellent layers, inclined to be small in body, but very hardy and precocious.

Campines.—This is considered the great egg-producing breed of Belgium. Except in comb, it resembles our Pencilled Hamburgs. The body is small, but they are fairly hardy, and excellent layers.

Hamburgs.—There are two distinct varieties of these lovely fowls, the Pencilled and the Spangled. The Pencilled were probably imported from Holland, where they were known as the Everlasting Layers. The Spangled and Black varieties belong to this country.

The plumage of some of the varieties is truly magnificent, and the well-shaped bodies show it to every advantage. Though all varieties are good layers, they are not so strong in constitution as some of the other breeds mentioned, and the eggs are rather too small to realise the highest price.

Scotch Greys.—This is a very old typical breed, very hardy, and capital layers of large-sized eggs.

Table Breeds.

Dorkings.—The Dorking is one of the oldest and best known of our truly English breeds. There are several varieties—Darks, Silver Greys, Cuckoos, Whites, and Reds. The first two are by far the most popular. In fig. 718 a coloured Dorking cock and hen are represented.

The Dorking is essentially a table breed, the flesh being pure white in colour and very delicate in texture. The body is large and deep, and, looked at sideways, should appear almost square. The legs are short, pure white in colour, and carry the characteristic of the breed—the fifth toe. They attain a very large size on favourable soils, but some breeders think the chickens are delicate to rear.

Indian Game.—This is truly a valuable breed for table purposes. Though somewhat heavy in bone, they carry a large amount of flesh on the breast. The head is broad and massive, neck arched, the body very broad across the shoulders and wide in chest, legs rich orange colour, medium in length, and set well apart. For crossing with other breeds the Indian Game is even more valuable than as a pure breed. Fig. 719 represents an Indian Game cock and hen.

Old English Game.—Though smaller than the Indian Game, the Old English Game are of superior quality of flesh, which is close in texture and pure white in colour. There are a good many sub-varieties, but the white-legged ones are preferred. The body is medium in size, broad in breast, close, compact, and hard in feather. It is a very hardy breed, suitable for almost any climate. Fig. 720 shows an Old English Game cock and hen.

Sussex.—The Sussex is a very large square-bodied fowl, resembling the Dorking in type though not in colour, and without the fifth toe. The flesh is of excellent flavour and very white in colour.

General Purpose Breeds.

Orpingtons.—This is one of the best, if not the very best, of the general purpose fowls ever introduced. There are now a few varieties of this deservedly popular breed—Blacks, Buffs, Whites, Jubilees, and Spangled, the best known being the first three. All are of the same blocky type,—full round breasts,

very deep in body, short in back, and short on leg,—perfect models of symmetry and shape. The chickens grow rapidly, and are extremely hardy, being suitable for any climate. As winter layers no breed can excel them, and the eggs are of fine shape and brown in colour.

For general farm fowls the Buffs and Whites are hard to beat. A Black Orpington hen is shown in fig. 721. Fig. 722 represents a pen of White Orpingtons.

Wyandottes. — This is a breed of American production, and is a credit to our cousins across the ocean. It has taken an extraordinary hold on poultry-breeders in this country, and has been a source of great profit to them. There is no need to describe all the varieties of the breed. It will be sufficient to enumerate the best known of them. The Silver, Golden, Blue-laced, Buff-laced, White, Partridge, Silver-pencilled, and Black are all as distinct in colour as their names imply, though in shape and general characteristics they are much the same. They stand on longer legs than the Orpington, and are not so heavy, but they have much of the same compact cobby build of body. All have rosecombs, and rich yellow legs.

For egg-production they are equal to the Orpington, and the egg is about the same shade of colour, though rounder in shape. An excellent all-round fowl it is. Fig. 723 represents a White Wyandotte cock, and fig. 724 a White Wyandotte hen.

Plymouth Rocks. — The Plymouth Rock is another American production, and the favourite breed of that country. The barred variety is the most popular, though there are Buffs, Whites, and Blacks as well. The Rocks are a very large, rather heavy-boned breed, with clean, rich yellow legs, and a constitution so vigorous that they can stand the most exposed situation. They lay a rich brown egg of good size, and come earlier to maturity than some of the other breeds. A Plymouth Rock cock is shown in fig. 725, and a Plymouth Rock hen in fig. 726.

Langshans. — These are jet black fowls of Chinese origin, with long, slightly feathered legs. In recent years the modern type has developed such length of limb as to make it ungainly, though the original fowls imported from China were a most useful breed, and grand winter layers of large deep-brown eggs.

Fancy Breeds.

The "fancy" breeds — those kept mainly for showing — need not be described in detail here, as they are not suitable for farmers, though a great interest is taken in their production by other classes. The breeds of poultry mentioned and briefly described above are the best known, and probably the most profitable from the utility point of view; and, speaking generally, it will be found much more advantageous to keep one or other of them only, or a first cross between two of them, than to keep a mongrel stock. Keepers of poultry should study and settle definitely what they mean to breed for. If eggs are likely to give most profit, then by all means keep a variety, or varieties, suited for that purpose, and not such a breed as Indian Game. If, on the other hand, table fowls are desired, then choose one or other of the table breeds. Where good egg-production combined with good table qualities is wanted, then one of the general-purpose fowls will suit best.

Cross-bred Poultry.

Regarding the raising of cross-bred poultry, excellent results in eggs will be got by crossing Brown Leghorns with Buff Orpingtons, or White Leghorns with White Orpingtons, or indeed any of the Leghorn or Minorca breeds with any of the Orpington, Wyandotte, or Plymouth Rock breeds. For table purposes nothing can be much better for quality than a cross between the white-legged Old English Game cock and the Dorking, Sussex, or Buff or White Orpington hen, though by using the Indian Game cock with the same hens or with Faverolles bigger chickens will be got. The latter cross is, however, rather coarser in bone and bigger in thigh. The chickens of either cross will be found extremely hardy, will grow rapidly, and will be ready for the table, weighing from 3 to 4½ lb. each at from thirteen to fifteen weeks old, at

which period they are at their best. If allowed to grow beyond this age, the frame, especially in the cockerels, begins to rush up, the first real feathers begin to come in, and the birds have to be kept till full grown, and moulted before they will fatten properly. If they are kept, however, till from eight to ten months old, they will be grand specimens, with plenty of beautiful breast meat, and weighing from 7 to 10 lb. each.

Advantages of Pure Breeds.

While crossing can be strongly recommended for certain purposes, there are still a great many advantages in keeping the breeds pure. The first is, that a better price can be got for any surplus stock which has to be disposed of. The best of the pure cockerels can usually, with a little judicious advertising, be sold for breeding purposes at from 4s. to 10s. each, and the pullets, particularly of winter-laying breeds, can be easily sold in the autumn at from 3s. to 4s. 6d. each. These prices are by no means overstated, and no account is taken of any birds which might be good enough for the show pen. For these any price may be got, according to their quality.

Another advantage of pure breeds is the uniformity of the eggs as regards shape and colour, and even this point tells in the marketing. Still another benefit is that in the spring of the year, when eggs get cheap commercially, a fair trade can be done in selling sittings for hatching purposes at from 2s. 6d. to 10s. per sitting, according to the quality of the stock birds. Nothing of this can possibly be done with mongrels, and all the time the pure birds are eating no more, neither are they costing any more to manage.

Numerous instances could be given where the fowls kept on the farm or at the cottage are of one pure breed, and where trade of the kind indicated is profitably carried on. Large sums of money frequently pass from the big exhibitors to the small careful breeders for the pick of their season's chickens. For small crofts or holdings, or even cottages, the greatest profit will undoubtedly come from a carefully selected stock of a single pure breed.

DUCKS.

The principal breed of ducks is the Aylesbury, which are of large size, with long, deep, straight keel, pure white in colour, and of pronouncedly rapid growth. The name is taken from the Vale of Aylesbury in Buckinghamshire, where the breed flourishes remarkably well, and from which a very large business is done with London in the duckling trade. This, then, is the variety for early maturity, the ducklings coming up to 4 lb. weight at eight to ten weeks old. Rouen ducks are in plumage almost identical with the Mallard or Wild-duck. This variety grows to a larger size than any other variety, but it matures slowly, and so is more suited for winter fattening. When fully matured, some specimens attain from 9 to 11 lb. each. They lay well, the flesh is of fine quality, and they are extremely hardy.

Pekin ducks are of Chinese origin, and have been largely used for crossing purposes to give stamina to our home breeds. Though as a pure breed it does not equal in usefulness the Aylesbury or the Rouen, unless in that it is a slightly better layer, still the progeny of the cross between it and either of these breeds will mature with greater rapidity, and attain greater weight than the Aylesbury or Rouen, and it is for the purpose of crossing that the Pekin is most largely used. The colour is a very pale shade of canary, and the carriage is upright, somewhat resembling that of a penguin. The legs and bill are a deep orange, and the body is profusely feathered.

Indian Runner ducks, the great egg-producing variety, are noted also for their great foraging habits. They are in many respects an ideal farmer's breed, for, though small in size, they yet make a fair appearance on the table, and they may be said to be, in suitable places, everlasting layers. The colour is most attractive, being a mixture of fawn and white, and they very seldom go broody.

A first cross between the Indian Runner and Aylesbury makes an excellent all-round duck, combining both laying and table qualities.

Fig. 714.—*Minorca cock.*

Fig. 715.—*Minorca hen.*

Fig. 716.—*White Leghorn cock.*

Fig. 717. *White Leghorn hen.*

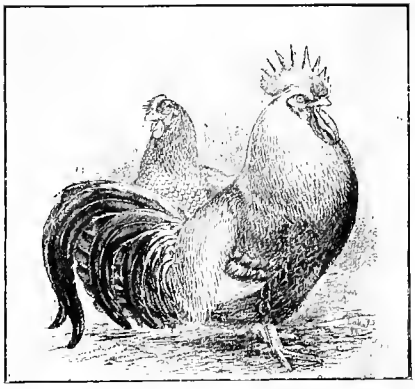


Fig. 718.—*Coloured Dorking cock and hen.*

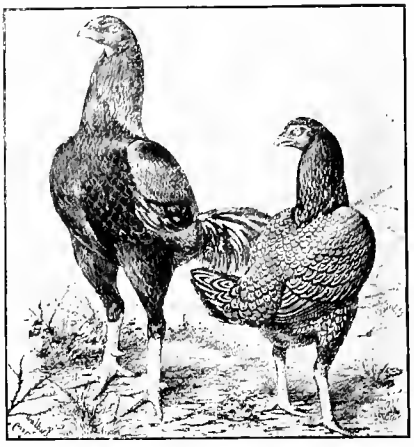


Fig. 719.—*Indian Game cock and hen.*

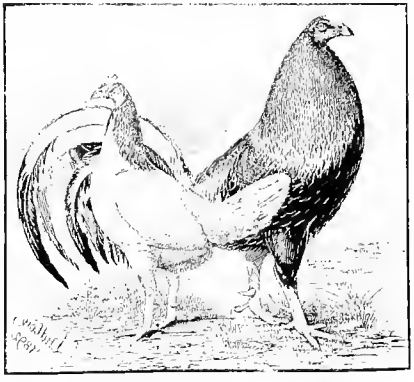


Fig. 720.—*Old English Game cock and hen.*

Fig. 721.—*Black Orpington hen*

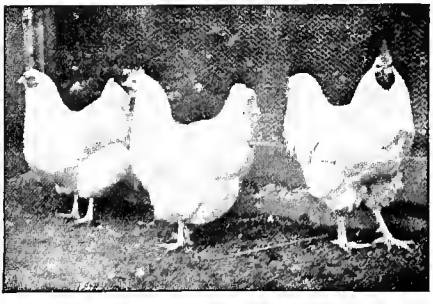


Fig. 722.—*White Orpingtons.*

Fig. 723.—*White Wyandotte cock*

Fig. 724.—*White Wyandotte hen.*

Fig. 725.—*Plymouth Rock cock.*

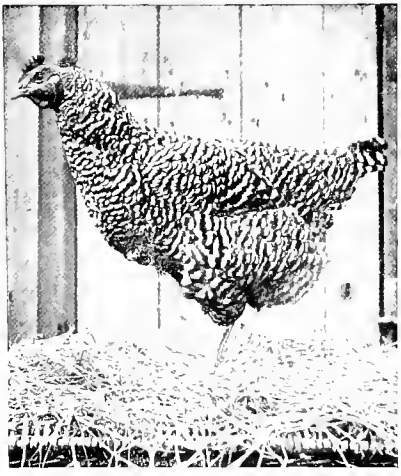


Fig. 726.—*Plymouth Rock hen.*

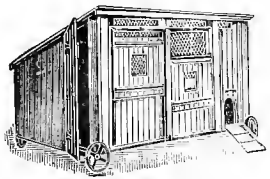


Fig. 727.—*Poultry-house on wheels.*

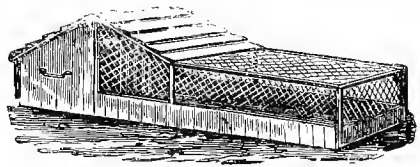


Fig. 730.—*Coop and run.*

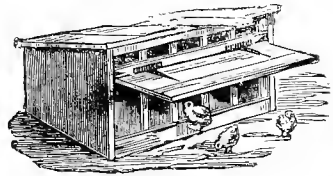


Fig. 731.—*Shelter-coop.*

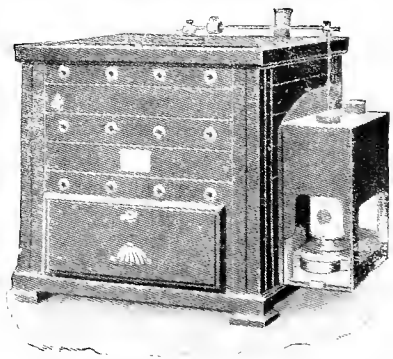


Fig. 733.—*Incubator.*

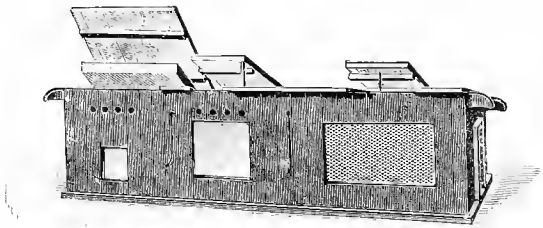


Fig. 734.—*Foster-mother for rearing chickens.*

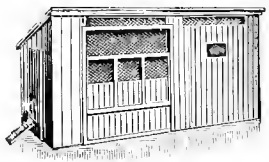


Fig. 728.—*Movable poultry-house.*

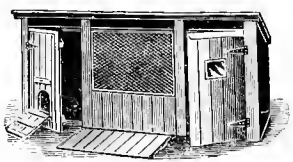


Fig. 729.—*Movable poultry-house.*

Fig. 732.—*A colony poultry-farm.*

GEESE.

Geese might well be more numerously kept than they are. They forage so well for themselves that the cost of keeping is not large. Whether they will be profitable or not depends on the situation of the farm. On waste or marshy ground they will practically require no feeding. Geese always command a ready sale at Christmas time.

There are two main varieties of geese, —the Toulouse or Grey, and the Embden or White.

Toulouse Geese.—The Toulouse is the more common variety, and has a most solid substantial appearance, being short in leg and very square and massive in body. In colour it strongly resembles the grey-lag wild goose, with bill and feet a dark orange. It lays wonderfully well, and, as a rule, is a non-sitter. This variety is slow in maturing, though it finally attains a great weight. When growing the frame develops rapidly, but very little flesh is put on till the body is full grown. This variety is thus not suitable for killing as green or Michaelmas geese, its special use being for the Christmas trade.

Embden Geese.—This variety is white in plumage, and of more upright carriage than the Toulouse. It also matures much earlier, and is thus ready for the autumn demand. The quality of flesh is about equal in both varieties, and very often they are crossed for general purposes. The white feathers of the Embden are of value, so it has this advantage over its rival. The Embden is an excellent sitter and mother.

TURKEYS.

It is now generally admitted that our domestic turkey is descended from the wild species of North America.

American Bronze Turkeys.—The American Bronze is the most common variety, as well as the largest and handsomest. The colour is a dazzling lustrous bronze on the back, neck, and tail, with black breast and body, which is pencilled with white. The flavour of the flesh is said not to be so delicate as that of our English breeds, but this is compensated for by a much greater size, some specimens weighing up to 50 lb., though 35 lb. is a very good weight for a cock and 20 lb. for a hen. An additional advantage of large size is that more is given per lb. for the weightier birds.

English Turkeys.—The Cambridge variety is common in some parts of England, and so is the Norfolk or Black turkey; but both are smaller than the American Bronze, and also somewhat more delicate to rear.

Pure and Cross Stocks of Ducks, Geese, and Turkeys.

To ducks, geese, and turkeys the same general remarks apply in regard to pure breeds as apply to poultry. In every case much of the ultimate success depends on the judicious choice of a breed or breeds. For that no hard and fast rule can be laid down, so much regard must be paid to soil, climate, situation, distance from markets, &c. Each individual breeder must therefore choose for himself: first, whether eggs or table fowls shall be made the first consideration; and secondly, which breed or cross will suit his special circumstances best.

Some are reluctant to take up pure breeds because of the initial expense and trouble incurred, but these objections are very easily overcome.

One very cheap and easy method of changing a stock is to buy a sitting or two of eggs from a reliable breeder of the new breed selected, the following spring buy a few more sittings of the *same breed*, meantime selling the old stock off gradually, and in a few years a complete change will thus be effected.

Another easy plan is to buy a cockerel and five or six pullets, and hatch only the eggs from this pen. This means separating them from the rest of the stock, but that can be very cheaply and easily done with some wire-netting and a movable house.

In any case, no initial trouble should be spared to get a start with the best varieties—that is, the varieties which will be the most profitable.

HOUSING POULTRY.

In no department of poultry-keeping has so much change taken place as in

that of the housing of the birds. Old ideas of warmth for the fowls, which usually meant overcrowding and no ventilation, have been entirely given up, and more hygienic methods have been introduced. There is still, however, far too little attention paid to this important matter. Hen-houses at farm-steadings are too often in the very worst position possible. It is not uncommon to see a cart-shed, implement-shed, or tool-house with a nice sunny southern exposure, while the hen-house is facing the north. In looking broadly at the subject, housing may be considered under two heads—"fixed houses" and "movable houses."

Fixed Houses.

As regards fixed houses, it will be better to indicate a few general principles which should apply to them rather than lay down hard and fast rules.

First, then, all houses should have light. There is nothing which can purify or warm the air of the house like the light of the sun, and this should be admitted freely by a large window set in the wall so that the light can reach the floor and walls. So much the better if the window is fitted on the inside of the wall, and made in two halves to slide fully open each way. With wire-netting over the outside to keep out unwelcome intruders, the window can be left open night and day in summer.

The perches should be all on one level, about 2 feet from the ground, 18 inches apart, and easily movable. Each perch should be about 2 inches broad, and rounded at the edges. Nest-boxes should also be easy to move, and set quite low, about a foot from the floor, and not made fixed in tiers right up to the top of the wall. The reason for movable perches and nest-boxes is to make the process of cleaning out as easy as possible. By removing everything to the door it is a simple matter to go over walls and floor thoroughly. This should be done, and fresh chaff put in, 4 to 6 inches deep, at least once a-week. Where the floor is of cement a hose-pipe can be used to scour the whole place out properly at intervals.

Cleanliness. — Cleanliness is of the utmost importance. The house should be brushed out once a-week or so, and the walls should, at least once a-year, get whitewashed with hot lime, to which a little carbolic acid has been added. Cleanliness applies to more than the house: it applies to all drinking-vessels and food-troughs, and to the birds themselves. Very few would believe the number of insects which may be found on a hen of any average flock. This can be remedied by providing a good dust-bath, roofed over, but quite open to the front, with a board nailed up about 8 inches to keep the material in. Good sharp sand and ashes mixed make a capital dust-bath, and should be always available.

Ventilation. — About ventilation in poultry houses some curious ideas are entertained. Some people cannot distinguish the difference between a current of air being allowed to blow straight in on the birds and proper ventilation. Ventilation means the proper regulation of a current of fresh air getting into the house, with equal means for the bad air to get out. This can be secured in several ways which are well known, and which need not be detailed here. It is sufficient to state that abundance of fresh air should be provided, for there is no more frequent cause of disease than vitiated air.

These, then, are the main principles of housing—Light, Cleanliness, and Ventilation. They are not mere details, as some think, but matters of the very utmost importance, because on their observance depends the health of the birds, and it is folly to expect good laying results unless the fowls are in perfect health.

Movable Houses.—Movable houses are becoming more and more in evidence every year. The "colony system," as it is called, of dividing up the fowls into small flocks, of from 15 to 30 or 40 birds in each, has practically revolutionised poultry-keeping. The houses used with this system are usually made in sections to bolt together, so that they can be readily taken down and put up again. For convenience in moving from field to field or for changing to a fresh piece of ground, a great many of the houses are on wheels (as in fig. 727), or on slides (as in figs. 728 and 729).

Each house has a shelter of some kind for bad weather, either under the raised floor of the house or as part of the house itself. Shelter-coops such as are shown in figs. 730 and 731 are also used largely. Fig. 732 gives a general view of a colony poultry-farm, photographed with the camera looking northwards.

In every case there is light and ample ventilation. Some of the newest designs are almost entirely open-fronted, being only boarded up about 2 feet, the whole of the rest of the front being lined with wire-netting. With both sides and back solid, all fear of draught is avoided, and the birds seem to do excellently.

Such a system as this has everything to recommend it. The fowls are in a natural state, living in healthy surroundings, and picking up a large share of their own food. After harvest it is usually a profitable plan to stock the stubble-fields with groups of young birds. The grain is there in plenty,—grain which would otherwise go to feed the multitude of wild-fowl, and small birds of all kinds, and it is noteworthy how plump pheasants and partridges usually become from just this kind of feeding. Besides gathering the grain, which would otherwise be lost, and turning it into profit, the fowls consume a very large number of insects. This, with the open free life, builds up such a constitution that disease is almost unknown in well-managed "colonies." The cost of attendance is also reduced to a minimum.

Not only on stubbles can this system be practised, but on pastures as well. Oftentimes the houses are put beside some natural shelter, such as a clump of trees, a hedgerow, or dyke, and no doubt some natural shelter is desirable from bad weather, and from the sun as well. Were it not for foxes this system would be much more widely adopted than it is.

Feeding Poultry.

It is undesirable to prescribe very definite rules regarding the feeding of poultry, because ideas are always changing, and there is still a good deal to learn. Chemistry has been of the greatest value in determining the component parts of the various foods, but experience only can teach the action of the different foods on the body. By combining the knowledge chemistry has put at our disposal with the experience gained from observation of the suitability of certain foods, we are able to compose a properly balanced food.

In the feeding of ordinary laying stock, the point to be aimed at is to keep the hens up to full laying limit and yet keep their bodies properly nourished without running to fat.

Much, naturally, depends on the conditions under which the birds are kept, and the quantity and nature of the food which they can find for themselves. Birds kept in confined runs must have their bill of fare much more carefully selected than those running out on pasture or stubble-fields, where worms, slugs, and snails can be picked up freely.

Hand-feeding for Laying.—The usual plan of feeding ordinary laying stock is to give a hot meal of soft food in the morning, and grain for the evening meal. For the preparation of the soft food it is very convenient to have a stock-pot, into which are put all the house scraps, such as beef bones, meat or fish scraps of any kind, crusts of bread, potato or vegetable leavings,—in fact, anything of the food kind left over from the table. Cover over with water and boil the whole at night. In the morning it has only to be heated to be ready to mix with the meals. In mixing, a handful of common salt should be added, and once a-week, or once a-fortnight, Epsom salts should be substituted for the common salt. The meals to be used should vary with the season of the year, the heat-giving and fat-forming meals being discontinued or reduced in quantity in the warmer months.

Meat in some form is now considered imperative. Where large quantities of fowls are kept, raw horse-flesh is the cheapest and best form in which it can be supplied. In the case of cattle and sheep that have died, it is better to boil the flesh for fear of disease, and this also holds with butcher's offal, which should be cooked till it is soft.

Fresh-cut bone will take the place of meat to some extent, but it is expensive to buy, and though there are hand-

machines for cutting it, the work is rather stiff. When neither flesh nor bone can be got cheaply or easily, meat-meal should be used. This should contain 70 per cent of albuminoids, and for small stocks of poultry it is cheaper and involves less trouble than other kinds of flesh.

Twice a-week is often enough to supply a flesh diet if the fowls get as much as they can eat. The price of meat-meal is about 14s. per cwt. The principal meals are sharps, oatmeal, barley-meal, Indian meal, pea-meal, and bran. For summer feeding to mix with the contents of the stock-pot, assuming that meat-meal is used instead of flesh, a fair ratio would be—

2 parts sharps.
2 parts meat-meal.
1 part oatmeal.

For the afternoon feed of grain, 2 parts oats to 1 of wheat.

For winter feeding—

3 parts sharps.
2 parts meat-meal.
1 part Indian or pea-meal.
1 part oatmeal.

For the afternoon feed—

3 parts maize.
3 parts wheat.
4 parts oats.

These, of course, may be altered to give variety, as, for instance, rice boiled in milk for summer, and boiled wheat or maize in the winter time. Vegetables ought to be freely used; swedes, mangels cooked or raw, also chopped clover and cabbages. In summer, clovers, green pea-haulm, lettuce, or any garden vegetable may be given. Cooked turnips are excellent for mixing with the meals, and so are potatoes occasionally, but not regularly.

Grit. — Grit is so essential that it might almost be considered a food. A considerable variety of this material should be constantly available, such as road scrapings, broken brick, coal-ash, lime or mortar, broken crockery, oyster and other shells. From the grit fowls get mineral matter, so that it is really something more than a mere aid to digestion.

Fattening Poultry. — The fattening of poultry is now a specialised industry. In this case the feeding adopted is largely Sussex ground oats, with milk and fat added. The birds are usually finished by a period of "cramming," which leaves the flesh very white in texture and delicate in flavour. "Hopper feeding" is now extensively adopted in America and some parts of this country. The idea is to have constantly before the birds a supply of food which they can eat at will. These hoppers, which are made of wood, consist of a reservoir with sloping lid, and a tray below into which the food falls. As the birds eat more comes down, so that the action is automatic.

Biscuit meals of various kinds are also extensively used in feeding, either alone or in combination with other meals.

Feeding Chickens.—Chicken-feeding may be said to be an industry by itself. Each system has its group of adherents. The system of "Dry Feeding," which originated in America, has many advocates, though its opponents say that the chickens so reared never attain the same size of frame as those which have had soft food supplied to them.

The dry chick feed consists of small seeds such as the seeds of dari, lint, and hemp, with wheat, groats, and rice. The commonest feeding for chickens is usually dry stale bread-crumbs, oatmeal, and hard-boiled eggs.

Another kind of feeding is a custard made with eggs and milk. As the unfertile eggs can be used in this way, it is cheap and certainly gives good results.

Another system is to give nothing but fine grit and water for the first two days, and then begin with stale bread-crumbs soaked in skim-milk and squeezed fairly dry. After this the dry chick feed is partly adopted, along with soft food cooked with milk.

Many specially prepared chicken meals are also most successfully used, either by themselves or in combination with other meals.

The greatest care has to be taken for the first fortnight or three weeks, as the heaviest losses occur during the first week through over and improper feeding. Tainted ground, body lice, and dirty drinking-vessels are also frequent causes of mortality. Cleanliness is absolutely essential, and milk given freely to drink is a splendid source of nourishment.

General Points in Poultry-feeding.—The whole question of poultry-feeding is of absorbing interest, and demands careful study. Different breeds require different treatment. Mediterranean non-sitting varieties can stand a richer diet than the heavier, less active sitting varieties. It is a good plan for poultry-feeders to make frequent experiments with different materials and rations.

INCUBATION.

The first essentials for the securing of good hatching results, whether by natural or artificial means, are the health and stamina of the stock birds from which the eggs are gathered. Eggs from birds properly mated, and enjoying their liberty, as they do when the "colony" system is pursued, are very little trouble to hatch, and the means used for hatching are of secondary importance. The natural and artificial methods have each their followers. Often both systems are used together with excellent results. With the spread of non-sitting varieties, broody hens are getting every year more difficult to obtain when wanted, and so the manufacture of incubators has gone up by leaps and bounds.

When eggs are being kept for hatching it is wise to turn them every other day, and not to set any over one week old if possible. Both the very large and very small eggs should be discarded for hatching purposes, and only the well-shaped ones free from all blemish selected.

Hatching Nest.—When hens are to be used the nest should be formed on a turf or sod, cut about 18 inches square, and from 4 to 6 inches thick. From the under side of the sod scrape away a little of the earth and then turn it back, green side up, and press it down in the centre to form a hollow big enough to hold the eggs. Cover this with chopped hay, straw, or chaff, and the nest is ready for the eggs.

A coop of some kind should be used in the early months — one made with the front hinged near the bottom, so that it will fold down, is very convenient for the hen leaving or returning to her nest.

Little more need be said about the care of the broody hen, except that her food should be of hard grain, that she should be taken off once a-day and have fresh water to drink and a dust-bath to clean herself in. Before the chickens are due, both the hen and the nest should be dusted over thoroughly with insect powder.

Use of Incubators.

The use of incubators is now very general. They are practically a necessity in order to get chickens when they are wanted. The principle of artificial incubation harks back to the ancients of Egypt and China. Large ovens were used for the purpose in those days, and it is really remarkable under what circumstances a strongly fertilised egg will hatch.

Many years of careful study and experiment have brought artificial incubation to a very high standard of perfection. In the machines now most popular there are two methods of supplying the heat. In the one the heat is supplied from a hot-water tank, and in the other by means of hot air. Both have their advocates, the hot-water machines being more common in this country, and the hot-air machines in America. Fig. 733 shows an incubator made by Phipps.

If the temperature of the room in which the machine is working be liable to great variations, then the hot-water principle will probably work the better, but so much really depends on the operator that it is unwise to discriminate too closely.

Moisture in Incubators.—The regulation of moisture to the eggs during hatching is one of the problems which is not yet finally settled. The quantity of moisture in the air is constantly changing, and this complicates the problem.

In hot-air machines there is no direct supply of moisture, the theory being that the ingoing air is raised in temperature in the heater, and gains moisture as it gains warmth, till the degree of humidity of the warm air is relatively equal to that of the outside air. After the air is heated in the heater, it is passed into the top of the machine, whence it travels by diffusion through a felt diaphragm to the egg-chamber, and finally, still travel-

ling downwards, it is ejected into the fresh-air inlet of the heater.

With hot-water machines the moisture is supplied from a water-tray placed immediately under the egg-drawer. The moisture-tray is covered with canvas, and the heat of the tank draws the air up by way of the ventilation holes in the bottom of the machine through the moist canvas to the eggs.

Much of the success of hatching depends on the regulation of the moisture. Some operators believe in dispensing with the water-tray altogether, or in putting it in about the eleventh day.

The room in which the incubators are to be worked should be thoroughly well ventilated, as the air in the egg-drawers must be constantly renewed for the proper development of the embryo in the egg.

Temperature in Incubators. — The temperature in incubators should vary as little as possible. Cellars are very often utilised as incubating-rooms, but it is usually difficult to get such places properly ventilated. Probably the safest temperature for the incubating-room is about 60° Fahr., and, as has been said, it should remain as uniform as possible.

The incubator must be set level, and on such a solid foundation that vibration will be avoided. The usual temperature recommended for the egg-drawer is 103° or 104°, but many operators now keep the drawer at 102° for the first week, 103° the second week, and 104° the third week, putting in the moisture-tray at about the eleventh day.

All well-made incubators are perfectly simple to work, regulating their heat quite automatically, so that no possible objection can be taken to them on that score.

The lamp must of course have attention. It must be kept perfectly clean and free from smell, but that is really a detail.

Necessity for Incubators. — The development of the poultry industry to meet modern demands can only be possible by an extended use of appliances. Early pullets are a necessity to supply the demand for fresh winter eggs, and spring chickens and ducklings must be hatched before the natural brooding time of hens arrives. Incubators are, therefore, bound to be more and more required, and improvements in their construction may even yet be possible.

Testing Eggs.—The testing of the eggs is a matter of economy as well as of necessity. This can be easily done after the fifth day of incubation, and the sooner it is then done the better. Testing lamps are simple and cheap, so that even the novice can, with a few lessons, detect the germ in a fertile egg. The removal of the infertile eggs leaves more room in the drawer, which can be filled up if desired, so long as the fresh eggs are not allowed to touch the older ones till they have been heated up, and this is easily avoided by putting a strip of cardboard in a piece of flannel between them. The infertile eggs can also, if removed before they have been too long in the machine, be used as food for chickens. One method of utilising them, as has already been mentioned, is to boil them into a custard with milk, this being really a capital food for newly hatched chickens.

When the chickens are hatching, the machine should only be interfered with occasionally to remove the chickens to the drying-box. The less disturbance the better. After each hatch, the water-tray, egg-drawer, and canvases should be thoroughly washed and disinfected before another lot of eggs is put in.

Rearing Chickens Artificially. — Artificial rearing is the natural sequence to artificial incubation, and there are now a very large number of rearers and foster-mothers for this purpose, such as is represented in fig. 734. The rearers are again worked on the two principles of hot-air and hot-water heating. There is a sleeping chamber, well ventilated, and warmed by a hot-water tank or hot air. This sleeping chamber usually occupies about one-third of the whole rearer, the rest being without floor and wire-netted in the front. They can be used outside in all weathers, and are of simple design and easy to manage.

Artificial and Natural Rearing compared. — Chickens artificially hatched and reared do quite as well as those reared by the hen, and are not in the least more delicate, although a prejudice still prevails against that practice. Many claim that having no contact with the hen keeps the chickens free from vermin, which is in itself a great consideration,

and also that the chickens get the full benefit of the food provided for them, and not the hen as often happens. Then with a machine there are no broken eggs or cases of desertion at a critical period. For convenience and economy, also, the balance is in favour of artificial methods.

MARKETING POULTRY.

There is often a great deal of waste through the want of a proper system of marketing. In the usual stock of farm fowls there are generally two kinds, the profitable and the unprofitable.

Unprofitable Hens.—It may be taken for granted that the young hens are paying their way, but too often there are a good many old hens which are not only unprofitable in themselves but which are eating away the profit the others are making. The question to decide, therefore, is: When does a hen cease to be profitable? Generally speaking, the answer is, after her second laying season is completed.

Assuming that a hen is hatched in March, she should in ordinary circumstances be marketed before the beginning of the August after she completes her second twelve months. The proper time is just after she has completed her period of laying, probably during June or July, and just before she begins to go into moult. To make sure a system of this kind is carried out, it is wise to mark each year's chickens with a ring on the leg. A brass, copper, or india-rubber ring does quite well, rings being made for the purpose.

The 1st of August sees the wild-fowl in season, and by the middle of the month the shooting is in full swing, so that fat hens are at a discount. The London markets, which really rule the prices all over the country, also invariably fall after August, so that there is nothing to be gained by keeping the hens over till Christmas. If this is done, the hens moult and fall into poor condition; they have to be fed up again while meantime laying no eggs, and Christmas markets are always glutted with foreign frozen poultry of all kinds. Moreover, these moulting hens are taking up the room of the younger birds, and, owing to cold and other causes, a good many of them contract disease, which is easily spread, and a few always succumb.

Chickens for Christmas.—For the Christmas markets it is an excellent plan to bring out a batch of chickens about July and August, which can be put out to the stubbles to grow. These chickens pick up a large part of their food in the corn-yards during and long after the stacking of the corn crops. With a little extra food before Christmas, the young birds always command a very good price, and leave a handsome profit. For this purpose the Game-Orpington cross can hardly be surpassed.

Winter Eggs.

Just as there is a right time to market the old hens, so there is a correct period for hatching. Winter eggs are a sure source of profit if they can be got, and that is now largely a matter which can be controlled. Taking advantage of the winter-laying varieties of poultry we now possess, beginning hatching operations about the middle of February, and continuing till the end of April, there will be no difficulty, under proper management, in securing a good supply of winter eggs.

Grown under ordinary conditions, without forcing in any way, pullets will naturally begin to lay at from six to eight months old. Pullets hatched in February, March, and April will therefore, as a matter of course, begin to lay in September, October, and November, and they should continue laying till spring, when they will have earned a rest.

Early Moulting.—Another distinct advantage accruing from the hatching of pullets in the months mentioned is that they will moult early, probably in July and August, and so be ready for laying again in the winter months. It is quite possible to induce the moulting process by keeping the birds on short rations for two or three weeks, then shutting them up in an open-fronted shed, and supplying them with heat-giving food, such as hemp and linseed. The period of moulting is also shortened by such special treatment.

Laying Competitions.—A great deal of good has been done by the laying

competitions which have been carried on from year to year. It is most satisfactory that the period of competition is now extended over a whole year. What is equally satisfactory is that a grant has been obtained from the Board of Agriculture towards the expenses of these competitions, thus for the first time giving them the advantage of official recognition.

These laying competitions have not only established facts regarding winter laying, but have indirectly yielded a vast amount of information on the different methods of housing and feeding.

Co-operative Marketing.

In the marketing of eggs this country still lags far behind some of her Continental neighbours, more particularly Denmark. Individual marketing, with all its inconveniences and losses, is still unfortunately the rule. Co-operation is slow to spread, even though our markets are practically controlled by eggs from other countries marketed on that system.

A great awakening must take place in this country before long if we are ever to attempt to supply our own markets with home-grown eggs. Were this country organised as Denmark is organised, the consumers who are willing to pay for them—and there are plenty of such—could depend on having on their tables every day guaranteed new-laid eggs not over three days old. With individual marketing, and the eggs passing through so many middlemen's hands as they do without organisation, the consumers do not know what they are buying. It is not to the credit of the British farmers that they allow their own markets, the best in the world, to be so largely at the mercy of the foreign producer when, by agreeing to combine, they could greatly improve this state of matters.

Co-operation in marketing poultry is not something new which has to be experimented with and tried with caution. It is already an established principle, ruling and guiding purchase and sale with manifest advantage to all poultry-rearers who have availed themselves of it. Under co-operation the eggs are collected, frequently tested for freshness, graded into sizes and colours, and marketed direct to the consumer. There can be no comparison between the individual and co-operative methods in dealing with the distribution of eggs.

In poultry-keeping British farmers have an ideal industry awaiting development. It is not from large farms devoted entirely to poultry-raising that our egg-supplies are likely to be obtained. It is from small flocks at every farm and croft in the country. The industry is eminently suited for cottagers with a small piece of ground and for small holdings, and every one of these should have poultry as part of their regular stock. There is no soil so poor, no climate so bad, no situation so exposed, as to render impossible the keeping of hens, ducks, geese, or turkeys; and, as has been previously pointed out, there are plenty of each of these classes of poultry to choose from. Poultry, however, must get attention, and it is urged that the same intelligence and forethought which are devoted to other kinds of farm stock should be given to them. Old ideas must cease to dominate this branch of agriculture, just as they have been superseded in other branches.

PRESERVING EGGS.

Use of Waterglass.—The advent of waterglass has rendered the process of preserving eggs so simple and cheap that it is now adopted in very many households. Waterglass is an alkaline silicate which effectually closes the pores of the shell, rendering it perfectly air-tight. There can thus be no evaporation, and the contents of the egg are preserved for months in a fresh state. When the eggs are taken out of the preservative and wiped with a clean cloth, they look as fresh and marketable as new-laid eggs.

It is advisable that all the water which is to be used to dilute the waterglass should first be boiled to kill the germs.

Almost any kind of vessels are suitable for storing the eggs, but probably wooden barrels or earthenware jars are the best. The liquid must fully cover all the eggs, and a cool place is best for storage. Full particulars for mixing the liquid are printed on each tin, and it is universally sold.

Lime-water.—Lime-water used to be the common preservative for eggs,

and it is still very largely used on the Continent and in this country too where large quantities are dealt with. A useful recipe for the lime-water is: 2 lb. lime, 1 lb. salt, 2 oz. cream of tartar, and 6 quarts of water.

The lime-preserved eggs are almost exclusively used for kitchen and cooking purposes, but it is claimed that by the waterglass method the eggs can be kept in a state fit for use on the table as boiled eggs. To prevent the shell of eggs thus preserved from cracking when being boiled, it is usual to prick the thick end of each egg with a needle.

Cold Storage.—Cold storage is also well adapted for preserving eggs, though evaporation is not prevented by the process. This method is, however, suitable only where very large quantities are handled. Both in the cooling down of the eggs and in the returning to the natural temperature a good many of the shells are apt to get broken.

Essential Conditions in Storing Eggs.—With all methods of preserving eggs the observation of the following rules is essential to success:—

1. The eggs must be perfectly fresh when put in.

2. Only eggs infertile and without flaw of any kind should be selected. Thin-shelled eggs should never be preserved.

3. Store in a cool place, as free from vibration as possible.

DISEASES.

In dealing with diseases of any kind, it cannot be too strongly emphasised or too often reiterated that "prevention is better than cure." Particularly is this so with poultry, because very often the disease is too far gone for cure before it is found out.

At farms where the fowls have their liberty and plenty of scope to roam, with healthy surroundings and a good supply of natural food, disease should practically be non-existent. Almost every outbreak that occurs can be traced to bad management in some form or other. Common causes are—

(*a*) Cold, damp, badly ventilated, and dirty houses;

(*b*) Over-feeding on too nutritious or fat-forming foods, such as maize and potatoes, and impure water;

(*c*) Overcrowding in a bad atmosphere;

(*d*) Want of healthy exercise, due to an improper system of feeding;

(*e*) Injudicious in-breeding.

Infectious Diseases.—In an ordinary farm stock, where the birds are not worth more than a few shillings each, by far the cheapest and most effectual plan is to kill off any bird which shows the slightest signs of having contracted an infectious disease, and one of the first precautions against disease breaking out is to see that every bird that is being bred from is in sound health. Further, if the principles laid down in the foregoing pages relative to the cleanliness and ventilation of the houses and the feeding of the fowls are adhered to, the chances of disease breaking out are remote in the extreme—more particularly if the colony system of housing is adopted.

Vermin.—Some of the worst plagues of the poultry-yard can scarcely be described as diseases, and one of the commonest of these is vermin. Unless fowls are minutely examined, particularly round the rump and under the wings, it is impossible to believe how badly infested they may be with insects. The presence of insects is a serious cause of loss both directly and indirectly. The constant irritation to the skin set up by these active workers is very often the cause of broody hens breaking their eggs; and further, the growth of the young stock is much retarded and the system so reduced that the way is paved for disease.

Bird-Lice.—Probably the most prejudicial kind of poultry parasites are the bird-lice. Eight species of these are found on the fowl, four on the duck, five on the goose, and three on the turkey. They may be said to spend most of their lives on their hosts, though certain species may live in the nests part of the time. These lice do not suck the blood, as is sometimes supposed; but they have a true biting mouth by which they gnaw away at the roots of the feathers, the scales, and the skin itself. On chickens these lice have a most injurious effect, and naturally the tender skin of the chicken

is chosen for their attentions rather than that of the adult hen.

The simplest way to check the ravages of these insect pests is to have a dust-bath, as already described, always handy, with some strong insect powder mixed in it. Finely divided gypsum mixed with a small quantity of paraffin or carbolic acid is very effective for these dust-baths, and soon gets rid of any insects which the birds cannot reach.

Broody hens should always be treated before being put on the eggs, and also before hatching, and so should each individual member of the flock occasionally.

A strong insect-powder such as Keating's, or two parts of that to one of powdered sulphur, well dusted into the feathers—more especially round the tail and under the wings—will effectually kill all insects. This treatment, however, has to be repeated, because the eggs of the insects are laid mostly round the roots of the downy feathers, to which they are attached by numerous fine threads, and in six to ten days the eggs develop into young lice.

Mites.—Mites are another source of trouble, but their haunts are the cracks and fissures of the perches, nest-boxes, &c. Hence the necessity for lime-washing all the wood-work regularly, and painting over with kerosene or spraying with dilute carbolic acid.

A very small tick-like mite also attacks the heads of chickens, and this attack can be met by a very small dressing of mercurial ointment or white precipitate, or by dressing with olive-oil to which a few drops of paraffin have been added.

Gapes.—Gapes is perhaps the worst scourge in the poultry world. It is due to the presence in the windpipe of a number of very small worms, which kill the affected fowl either by wasting or actual suffocation. The symptoms are yawning and stretching of the neck, a wheezing cough, and a frothy saliva oozing from the mouth. The surest preventive of this fatal disease is to use fresh ground every year for the rearing of the chickens, and to colour the water two or three times a-week with permanganate of potash.

When the disease does occur, the ground very soon becomes contaminated and the whole flock may be affected. One remedy is to put the affected chickens in a box and fumigate them with the fumes from carbolic acid. The vapour from burnt sulphur is also fairly effective. A little camphor added to the drinking-water is also a safeguard.

The disease is frequently connected with a large insect found on the heads of newly hatched chickens; and it seems to be established that gapes will not break out if the chickens' heads are anointed with the following ointment: mercurial ointment, 1 ounce; pure lard, 1 ounce; flowers of sulphur, ½ ounce; crude petroleum, ½ ounce. The ointment is gently rubbed in after being warmed to semi-fluidity. On clean dry ground, however, the disease seldom appears.

Scaly Leg.—Scaly leg is another common disease for which there is little excuse, as it is so easily cured. It is caused by an insect burrowing under the scales of the leg. The treatment is to wash the legs thoroughly in warm water, using carbolic soap and a hard nail-brush to get well under the scales. After drying thoroughly, rub well in sulphur ointment or creosote and lard ointment (1 to 20). Another cure is to boil equal parts of paraffin and water, and add a little soft-soap, rubbing this in under the scales after washing as described.

White Comb.—White comb, or favus, is another noxious disease, often caused by overcrowding in a dark, damp house. It attacks the comb, wattles, head, and neck, which appear crusted with a whitish-like growth. The method of treatment is to bathe the infested parts with warm water and soft-soap; then apply either red oxide of mercury ointment (1 part of mercury to 8 of lard) or sulphur ointment with a few drops of benzine, just enough to moisten the sulphur before mixing it with the lard. Iodine is also said to be successful.

Roup.—Roup and diphtheric roup are the most troublesome and loathsome diseases with which the poultry-keeper has to contend. The symptoms are easily detected, as there is an offensive smelling discharge of white cheesy like matter from the nostrils and mouth, and

the bird is highly fevered. There is also often a swelling round the eyes.

As this disease is highly contagious, the first thing to do is to isolate at once any bird affected, and disinfect the drinking-troughs, &c., it has been using.

In *diphtheric roup*, which is really distinct from common roup, the inside of the mouth and round the tongue will have small patches of matter growing which have to be scraped off with a quill or blunt knife, and the place anointed with an antiseptic such as salicylic acid. The mouth must be washed out by using cotton wadding attached to a small stick of wood dipped in peroxide of hydrogen. Sometimes hard white spots are found, to remove which lunar caustic will have to be used. To reduce the swelling round the eye, foment with hot water and drop into the eye a little powdered borax. Sometimes in bad cases the swelling has to be opened and the cheesy matter extracted.

The general treatment is to keep the bird in a warm, dry, airy room, giving a laxative in the form of half a teaspoonful of Epsom salts or castor-oil. Give the soft food seasoned with a little cayenne pepper, and administer a copaiba capsule a few hours after the laxative.

Specially prepared roup powders are now sold by most poultry chemists, and if these are given as directed on the first symptoms appearing, further trouble is often avoided. A few days' quarantine after cure is essential.

Liver Disease.—Liver disease, though more often associated with the larger breeds of fowls, is yet common to all, and is generally brought on by injudicious feeding on such heavy foods as Indian corn and potatoes, with insufficient exercise. The symptoms are moping, and a dark purple colour about the head. If the bird is handled it feels heavy, and if held head down for a minute or two, it will turn almost black, sometimes collapsing altogether.

A simple cure for a hen affected by this disease is to give her a sitting of eggs to hatch and let her rear the chickens. The fat in the body gets reduced, and in a manner the whole system renewed.

The treatment is to provide as much space and exercise as possible for the affected birds. A good dose of Epsom salts should be given. If given dry, in crystal form, which is the best way, a piece about the size of a marble to each bird is a good dose.

The following recipe by a well-known authority can be strongly recommended: "Get one pennyworth of gentian root, ditto of powdered rhubarb, ditto of bitter aloes, ditto of black Spanish, ditto of best cayenne. Add the above to one quart of water, and simmer down to a gill. Then strain through a fine sieve and let it cool. Boil till the nature is out of the herbs, when it is ready for use. Give eight to ten drops in a tablespoonful of water three times a-day for a week. Give also plenty of green food and grit, and a few cod-liver oil or chemical capsules."

A stock of birds affected with liver disease should not be bred from. It is far better to kill them and have a fresh lot put in. This is a disease for which there is no excuse, as it is so easily avoided by proper feeding.

Tuberculosis of Poultry.

In regard to tuberculosis, which is one of the most common diseases of fowls, turkeys, pheasants, and other birds, the following useful information is given in Leaflet No. 78, issued by the Board of Agriculture:—

Symptoms.—Affected fowls become anæmic, thin, emaciated, and they lose weight. Their appetite is impaired, and erratic feeding is noticeable. The comb and wattles and mucous membranes become pale, and there is usually persistent diarrhœa. As a result of extreme emaciation, which is the most noticeable symptom, the bones become very prominent.

Post-mortem Appearances.—The flesh is scanty and the muscles pallid. The liver is dotted all over with small pale spots, or larger patches of a white, grey, or yellow colour. The spleen is usually enlarged and beset with small or large tubercles. The intestines and the lymphatic glands of the mesenteries may be also the seats of tubercular deposits. Tubercles may likewise occur on the skin. There are very rarely small tubercles in the lungs.

Cause.—The exciting cause of the

disease is a bacillus which may be considered a variety of the bacillus of mammalian tuberculosis. It gains entrance with the food, fouled by means of droppings of affected birds.

Prevention and Remedy.—1. The most frequent source of infection is the poultry-house or yard, which receives the droppings of the affected birds, these droppings containing bacilli. Damp, dirt, and absence of sunlight greatly favour the spread of the disease. It is necessary that there should be good ventilation and strict cleanliness in the runs and sheds.

2. All diseased birds should be killed and buried in lime. The house where they have been should receive several applications of disinfectant, and the tainted run should be dug over and heavily dressed with quicklime.

3. Many months should elapse before birds are put back in old quarters that have been cleaned. It is best to clear off all stock where this disease breaks out, and make a fresh start with new stock later. Strong and healthy birds should be carefully selected and put into a new house and run, and if any show indications of disease, they should be removed at once and the house disinfected with chloride of lime (¼ lb. to 1 gallon of water). In this way a disease-free stock may be obtained, and until this is accomplished all that can be done is to observe all possible sanitary precautions.

Vices in Poultry.

Poultry have, unfortunately, a few vices which are as troublesome as the diseases.

Egg-Eating.—The habit of eating eggs is a common vice not easily detected or stopped. The habit is usually acquired from the devouring of a broken egg, thus creating an appetite for more. If the criminal (for there is usually just one real culprit) can be caught, the best cure is to twist its neck. The absence of grit, oyster-shell, and lime is given as a cause of egg-eating, and certainly these should be supplied in plenty. But the vice will appear even where there is no want of these substances.

A simple preventive of egg-eating is to have a good many nest-eggs lying about, so that these may get the attention of the culprits and disgust them. Another plan is to blow the contents out of an egg and fill it up with mustard, alum, and cayenne-pepper, so as to give a lesson to the hen which breaks it. Nests are also constructed so that the egg when laid rolls out of sight, but with big flocks the surest and best way is to execute the criminal.

Feather-Eating.—Feather-eating is a much commoner vice, though more prone to occur where the birds are cooped up. Probably the habit is caused in the first place by insects, but other causes are usually at work as well. A feverish state of body, through want of a plentiful supply of green food, or a craving for animal food, are undoubtedly predisposing causes. The cock often suffers, too, through the hens pecking at his comb and wattles till he is a pitiable object.

The treatment for feather-eating is to isolate any bird attacked, and see that the flock gets a regular supply of green food; also twice a-week, at least, some animal food, either raw or cooked flesh or green bone. The affected parts of the birds attacked should have carbolised vaseline well rubbed into them. This will cure the wounds, and at the same time prevent any more feathers being pulled out.

There are, no doubt, other simple and complex troubles which arise in the path of the poultry-keeper, but there is now an ample supply of literature available on almost any specific subject. No better medium of information can be wished than the weekly penny journals specially devoted to this subject, through whose columns information on any particular matter affecting poultry can be had for the asking.

BEE-KEEPING.

The keeping of bees is not only, as a rule, a profitable industry where it is conducted with skill, but is also one of absorbing interest and fascination. Originally the following notes on the subject were prepared for this work by the late Mr William Raitt, Beecroft, Blairgowrie. By another capable bee-keeper they have been revised for this edition.

Bee-keeping as a Farm Industry.—It is undoubtedly the case that bee-keeping ought to receive more attention as a farm industry than has hitherto been devoted to it. In many instances it has been cultivated as such with the best results. It is an industry peculiarly adapted for a place on the farm, as is indicated by the ancient and sacred association of "milk and honey." The same pastures yield both—though, alas! the latter is too often left to waste its sweetness on the air.

In America and many Continental countries bee-keeping already occupies a prominent place among rural industries, and is generally most successful when associated with farming. A few regions, like San Diego County in California, the Basswood tracts in other States, and, to a degree, our own heath-clad hills, afford unlimited natural honey-yielding bloom.

Clover for Bees.—But more generally success depends on the neighbourhood of clover-fields. Than these there are no better pastures for bees, as every farmer must perceive when he hears the joyous hum of *other people's* bees rollicking amongst *his* clover heads.

These "small cattle" are so independent of fences, that in a notice of the sale of an apiary there was added after the inventory of hives the words, "with unlimited right of pasturage." But just because these cattle are so small, they are often neglected. One forgets, however, that what they lack in bulk they compensate for in energy and in strength of numbers, so that the results of their united labours are, under proper conditions, out of all proportion to their "stature."

Bees *v.* Shorthorns.—Some years ago the writer was at tea in the company of several farmers, who chaffed him not a little on having a "bee in his bonnet." *Their* talk was of shorthorns. "I'll tell you what it is," said I, "I have a single bee at home that has this year put more money into my purse than the best shorthorn cow you have has put into yours." I of course referred to the queen-bee of one of my hives, the mother of all its inhabitants. It so happened that I had that season taken from that stock no less than 130 lb. of first-class honey, in such splendid condition that I sold it to a dealer, after winning a handsome prize besides, for £10, 16s.

Produce of Hives.—It is but fair to say, however, that that result was exceptional, though I have several times greatly exceeded it in quantity since. For instance, I had in one season from a single hive 204 lb. of bottled honey of first-class quality, and an almost equal amount from a hive the year before, and all without killing the bees or interfering with their necessary winter stores. These figures indicate the possibilities that lie in bee-keeping—though, taking one season with another, I should estimate the average produce of a well-managed apiary at from 30s. to 40s. per hive.

Commencing.

The times are propitious for commencing this industry.

Improved Practice.—A great revolution has taken place in the practical management of bees since the "seventies" of last century. The old straw skep and brimstone system have been improved away, and the new humane and profitable movable comb system has taken its place.

After many years' experiments with mixed success, the best form of hive and system of management became pretty well fixed. The era of experiment is past, at least to a large extent, and everything has been greatly simplified.

Cheap and Improved Appliances.—Not only so, but while in former years

new hives and appliances were rather expensive articles, they are now very moderate. I remember when no hive was considered good for anything under £1 or 30s. Now they can be had for half the amount, and simpler forms for a good deal less—so simple, that with one as a pattern any handy man can make his own hives.

Marketing Honey.—Moreover, the chief initial difficulties connected with making a market for honey are overcome. It has become a staple article of trade in the best shops of all our large towns. To be sure the price, like that of all other sweets, has come down in late years; but even yet it has not fallen to the price that used to be considered a fair one for old-fashioned skep honey, and it is not likely to come lower.

Bee Information.—And lastly, information is now more easily attainable than ever it was before. Besides weekly and monthly journals entirely devoted to bees, most agricultural and horticultural weeklies have columns devoted to the industry and to the queries of correspondents. And special handbooks and more elaborate volumes are easily obtained.

Exhibitions illustrative of the whole art and mystery are held annually in connection with the shows of most of the leading agricultural societies in the three kingdoms, and at many local shows besides. Then almost everywhere a handy man can be picked up who will be delighted to tell all he knows, and give all the help he can to intending beginners.

Knowledge necessary.—Bee-keeping as much as sheep-farming and other rural employments requires the application of a good deal of acquired information. One may, however, commence practice and the study of principles at the same time—that is, commencing on a small scale, and increasing one's stocks as one's knowledge and ability advance. The limits of space here forbid anything more than a digest of the knowledge any one may easily acquire more fully from books and experience.

In regard to books, beginners should be careful to get only the latest editions of the latest published works. The beginners should on no account allow themselves to become enraptured over any particular form of hive recommended by the maker. Study the latest information obtained from a disinterested quarter, and then judge for yourself what would best suit the object you have in view in the way of system and appliances.

After having thus formed a decided plan of operations, there need be no objections to reading any good works on bees, with a view to obtaining more scientific knowledge than most handy manuals can afford to give. Much also may be at the same time learned, and more especially in the art of handling bees, by a visit to some successful bee-keeper.

Principles of Bee-keeping.—As some guide towards judging as to the suitableness of any reading that may be undertaken, we give the following condensed summary of what we consider ought to be learnt from it: that modern bee-keeping is an art founded on strict scientific principles; that it can be depended upon, weather alone permitting, for yielding certain fixed results, as surely as can any other industry about a farm; and that to enable one to use his scientific knowledge to advantange, hives must be adopted that give every facility for controlling all the operations of the bees, and for assisting them by the use of comb-foundations and other modern aids.

Hives.—Such hives are variously called bar-frame or movable comb-hives, and the tendency is towards great simplicity in these. The books and dealers' lists may, with great plausibility, recommend costly hives with elaborate fittings and adjuncts; but for profit and convenience none excel those that consist of simple box bodies fitted with plain frames with roof and floorboard. To allow of tiering up, with a view to the production of either comb or extracted honey, the bodies should all be exactly alike, and so fitted as to sit accurately one over another. That is, one may have any number of bodies or stories in use as a hive or stock, though with only one roof and floorboard. Hives with fixed legs should specially be avoided, any plain stand being substituted.

Appliances for Special Conditions.—The student ought also to learn that, in certain localities and under certain circumstances, it may be better to adopt appliances specially with a view to producing comb-honey, this especially where heather is plentiful; or that it may be better to work for extracted honey, as may be in most demand; or to work for both—say for clover-honey to be extracted, and for heather-honey in the comb.

Study Surroundings.—At the same time he ought to have his observing powers at work, more especially noticing the favoured bee-flowers peculiar to his neighbourhood, and their period of bloom. This knowledge will greatly aid him in forming his plan, for one of the great secrets of success is in having one's stocks in the very best condition, just when the prevailing honey-flow comes on, and not either still weak from spring neglect, or what is almost as bad, weakened by swarming after having been strong. The peculiarities of his location as to climate and exposure also merit attention. And as a result of all, he must make up his mind whether he can afford to give his bees the necessary time and attention, and in what particular direction he shall go to work.

Caution in Practice.

Obtaining Stocks.—Should such preliminaries chance to occupy him during the winter or early spring months, he may at once look out for the needful stocks. If these are already on hand, even though domiciled in ancient straw-skeps, so much the better; otherwise he may easily obtain by purchase one or more such. These are usually to be had so much cheaper than stocks in modern hives, and the experience gained in the course of working them into the new system is so valuable, all the more so because it compels him to "go slowly," that on the whole we generally advise beginners to commence with such.

By exceptional diligence in gathering information, and with that knack of managing live stock that many have as a peculiar gift, it might be safe enough to embark boldly in a wholesale fashion at first, but generally we recommend caution.

"Bee-fever."—Few become really successful bee-keepers until they have at least one whole year's experience, and it is better to try and control the "bee-fever" than to let it run riot, to the imminent danger of collapse and misfortune.

Appliances.

The needful appliances are by no means so numerous or costly as some of the many large and finely illustrated price-lists issued by dealers may suggest.

To begin with, at any rate, one's wants may be sufficiently met by the possession of a hat-veil, a smoker, a supply of hives, with the necessary frames, crates, and sections, and a stock of comb-foundations.

Hat-veil.—The veil is simply a yard and a half of black hexagon net, sewed up one seam with an elastic band, to go round a broad-brimmed hat, the lower edge to be tucked away inside the vest.

Smoker.—The smoker is a bellows contrivance for burning rags, brown paper, or touchwood, in such a way as to permit of directing a stream of smoke upon the bees when they are to be handled. A loosely tied roll of rag (corduroy or moleskin is best) may serve a turn instead, or the fumes of tobacco may be utilised by those who can use the pipe. This frightens and quiets the bees.

Hives.—The hives, as already hinted, should be of simple construction, each body made to hold not more than eleven frames.

The frames should be of the standard size used in the neighbourhood, hung in the hives, so that ten of them occupy a space of 14½ inches, that being also the dimension of the hive the other way. We prefer eleven frames, so that our hives inside measure 14½ × 16 inches, and are deep enough to hold the frames suspended, with the necessary bee-space below and around.

This size of hive is just about right for permitting ordinary-sized crates of sections to be piled up inside the upper storeys.

Sections.—Sections are those neat dovetailed boxes to hold one or two pounds of honeycomb, and are generally imported from America, and sold by dealers very cheaply.

Crates.—Crates are the bottomless boxes or trays in which the sections are arranged in groups of 21 or less, according to their size.

Comb-foundations.—Comb-foundations are sheets of bees'-wax impressed with the exact form of the cells as made by the bees. These are turned out by special machinery, and are a great help both in supplying the bees with material of which to build combs, and in compelling them to build them straight in the frames or sections where wanted, at the same time putting it in the power of the bee-keeper to limit the production of useless drones.

Other Appliances.—A few other minor appliances might be found useful, though not absolutely necessary, such as a queen cage or two, some queen-excluding zinc, bottle-feeders, and a honey-knife. The cast carpets or blankets about the house will supply all the quilts needed for a commencement.

Honey Extractor.—The question of having the rather expensive machine for emptying combs without breaking them—called the honey extractor—may be deferred till experience warrants the expense.

Management—Preliminary.

Driving Bees.—The first concern of those commencing should be, as soon as may be best, to get their bees domiciled in the new frame-hives. It is quite easy for experts to transfer both bees and combs from the one to the other at almost any season. The bees are "driven" into an empty skep, according to directions in the book referred to; the combs are then cut out, and pieced and tied into the new frames; these, with the bees, are then placed in the new hive, when they soon fix all nicely up.

But we advise rather to await the natural swarming season, when either swarms may be allowed to come off or the plan afterwards described adopted.

New Swarms.—If natural swarms be got, they should be treated thus: the first that comes off should be placed in the new hive on the stool where the skep stood, the latter being removed to a new location. This causes many more bees, accustomed to the old place, to join the swarm and strengthen it. The likelihood is that the skep will not swarm again. Should it do so, the swarm should be returned, and more ventilation given, as a preventive, till the 21st day from first swarming, when all brood will have been hatched out.

A second good bar-frame stock can now be had by driving all the bees and transferring any combs found straight and sweet. On no account would we advise more than two stocks to be made from one.

Another Plan.—The other plan is to set the skep when crowded with bees on top of a new hive fitted with comb-foundation, compelling the bees to work downwards through a 6-inch hole in the quilt, by closing their old entrance. If it be done at the right time, the bees will generally have some combs worked out below within a week, when an examination should be made of these to see whether the queen has gone below. The presence of eggs in the cells may generally be accepted as proof sufficient, but we should prefer in all cases to see her majesty. This being so, the skep may be lifted off and set in a new location, to be afterwards treated as if it had swarmed naturally, as before described.

Rapid Increase of Stocks.—To those anxious to increase their stocks as much as possible, it is a good plan to rear or purchase spare queens, so as to be able to introduce one into each skep as soon as it has been removed from its old place and queen. In that case the same process of stocking new hives may be carried out at the rate of one every fortnight or three weeks during the honey season.

In backward and ungenial seasons less must be expected, and, indeed, it is common to leave the skep in place on the first hive until all its brood is hatched out, when it is taken and treated as a honey super.

Purchasing Swarms.—Some may prefer, or have no alternative but to make a start by purchasing swarms wherewith to stock the new hives. These should be secured as early as possible, say by the first week of June in the south of Scotland, and a fortnight later in the north. They ought to weigh not less than 4 lb., an ordinary top skep swarm, though 6 or 7 lb. are usually had in a swarm from a good frame stock.

Collecting Driven Bees.—Still others may adopt the more economical though more troublesome plan of gathering up driven bees in the autumn, and by joining these into large colonies, and feeding rapidly with bottle syrup, get them into good shape before winter. Any one having learned the art of "driving," and having the soft side of cottagers who are going to brimstone their bees, may generally have them for the trouble of driving, though in most localities the cottagers are getting too knowing to give away what they may as well learn to use to their own benefit.

In whatever way obtained, let us suppose the reader to have in the autumn several good stocks of bees in modern hives. We would now indicate in the order of the seasons the system and treatment we consider best for him to adopt.

Wintering.

Secret of Success.—The great secret of successful wintering is in keeping the bees in as quiet a state and as constant a temperature as possible. Of course abundant supplies are the first consideration to this end, the next is careful packing and ventilation, and the third is to let them rest free from the least disturbance till the first of spring.

Preparing for Winter.—A warm day late in November is our chosen time for arranging hives for the winter. If made very comfortable long before this, the bees incline to fly too much and to dwindle. But left just as they were after the honey harvest, they have free ventilation and plenty of room, never get too warm, and stay more at home. As steady cold weather approaches we need not be so afraid, and so we choose such a day as mentioned to make all trim and comfortable.

Armed with smoker or other quieting agent, a bag of chaff, a quantity of extra pieces of carpet or other quilt materials, and some flat cakes of "bee-candy," we set to work. Hives still containing bees on every comb, or nearly so, we do not disturb further than to lay a cake on top of frames, cover closely with several thicknesses of quilt, and over all, if the make of the hive permits, pour a few inches of loose chaff, or stuff in a chaff cushion. The doorway is left full width, or at any rate not under six inches long.

The candy is given not solely to increase the supply of food, but because it supports the coverings, so that when eaten away there is a nice warm cavity left that forms the best kind of winter passage from one frame space to another.

Weak Hives.—Weaker hives, containing bees on six frames only, or under, are contracted by removing all the outside beeless combs, inserting division-boards next the remaining combs, and filling the spaces with chaff. Otherwise they are treated as before.

Very small stocks are united two and two, though this should have been done in autumn.

For the rest, no further attention is required till spring, unless one chooses to keep the snow well cleared away from the ground in front, and to watch on sunny days when the snow is soft, keeping the bees at home by heaping soft snow over the entrances. This shades and cools the hive, and affords the necessary water to the bees that are trying to get out to find it.

Bees not shut in.—On no account should bees be actually shut in, as they often get into such a state as to suffocate. Only *tempt* them to stay at home when it is dangerous for them to be out.

Experiments.—Quite probably the experiments we are conducting in the line of cellar-wintering, or by burying the hives in pits or clamps, may result in an improved system in that direction, which is so much in favour in America.

Spring Treatment.

Provided all goes well in wintering, there is really no necessity for disturbing the bees during early spring.

Breeding resumed.—They naturally recommence breeding about the New Year, and their stores thereafter more rapidly diminish; but they ought to have sufficient left them in autumn to carry them through till the first new honey is to be got, or till gooseberry and fruit-trees are in bloom.

Supplementing the Winter Food.—Wherever there is any doubt as to the supply of food, it is our custom to take a peep into all stocks on the first fine day when bees are flying. We are loath to

disturb the winter packing, which is of most value when the bees are breeding with diminished numbers in spring. We therefore simply raise the packing and quilts along the back edge of the combs, when it is possible to see whether there remains still a quantity of sealed comb in at least the most of the frames. If so, all is well so far as food is concerned, and it is too soon to inquire into other matters.

Where there is an evident deficiency in food, there must be a more thorough examination, and any want supplied, either by giving back any combs of honey reserved for this purpose, or by laying a cake of candy under the quilt.

Liquid Food.—Liquid food should not be given unless in desperate cases, when it may be poured into empty combs and hung in the hive.

Stimulating Stocks.—Later on, say when willows are in bloom, it will be of advantage to contract the brood-nest by removing all beeless combs and closing in the division boards, though many think it better to leave them alone. All depends on whether the district is one for very early honey, making it necessary to stimulate the bees by every means, so as to come to full strength before the honey season opens. With us the clover is the main harvest, commencing on an average about the 15th June, and our average stocks usually come to swarming strength by that time without any special stimulation, and thus the energies of the queen are conserved for keeping up the population till the close of the harvest.

Stocks stimulated to undue exertions early in the season are more apt to swarm excessively, and thus to imperil the honey returns.

Continuous Treatment. — As the bee-keeper's summer may be considered as commencing with the swarming season, or say from June 1st, we may add that whatever style of treatment may be adopted, in view of getting hives filled with bees and brood, should be continued without intermission till that period arrives. That is, care must be taken to see that once the bees have got started in earnest to brood-rearing there should be suffered no check from want of food or room. Both should be given in moderation, yet continuously; when plenty of natural stores are coming in, leave well alone, but supplement these either by bottle-feeding whenever the weather is unsuitable for outdoor work, or by uncapping portions of their sealed stores every day or two.

Pea-meal may be given as an equivalent or supplement to natural pollen when that is deficient, the meal being sprinkled on shavings in an old skep set to face the sun in a sheltered corner. Room need only be given where combs have previously been removed, by adding one at a time in the centre of the brood-nest, as the bees are able to cover all closely. So soon as the hive is full of bees from side to side, with brood in every frame, the summer treatment should begin.

Summer Treatment.

It should previously be matter for consideration and decision whether the various stocks are to be worked for (1) increase, or (2) honey.

Working for Honey.—If the latter, it has to be decided whether it is for extracted or comb honey. Every preparation should be made accordingly. New hives, ready fitted to receive swarms, should be prepared beforehand, upper storeys filled with spare combs or foundation for extracting purposes, and crates ready fitted with guided sections for comb honey.

Working for Increase of Stocks.—If increase be wanted, some such plan should be followed as indicated on preliminary management.

Extracted or Comb Honey.—As to whether one should aim at getting extracted or comb honey, each must discover for himself which is likely to be more saleable in his district. We may, however, indicate our opinion that, generally, extracted honey is likely to be more in demand than comb. They are rapidly approaching each other in price, the former being obtained with more ease and certainty, and in perhaps a third greater quantity. It is in demand all the year round, while comb unfortunately has its "season."

The Writer's Practice.—Our own practice, adopted after many years' experience, is as follows: We work for honey, but allow a moderate natural increase, partly to ensure our having old queens replaced by young ones, partly to

keep up our stock, so as to permit of doubling up weak colonies, and partly to allow the bees a little of their own way, which seems to keep them in better heart for work. That is, we do all we can towards getting honey, and in doing so to *prevent* swarming; but as occasional swarms will come off in spite of us, we do not try to thwart the bees by returning these, but make the best of them, by giving them a good start on combs ready built, or on combs of brood and foundation.

If second swarms issue, we cut out all royal cells and return the swarm.

By placing first swarms on the old stool, they are made stronger by the old bees returning to their accustomed place, and the removed stock is so weakened that it does not often swarm a second time. Sometimes we break up the latter, giving nearly all the bees to the new swarm, and dividing the combs of brood amongst those not yet at full strength. Of course we cut out royal cells, in case they may tempt the other stocks to swarm.

Controlling Swarming.—To prevent swarming, or at least reduce it to the lowest as a natural impulse, we find it generally enough to see that the bees have plenty of doorway and plenty of room for storage and for clustering inside.

This room we give them by tiering on upper storeys of combs for extracting, or of crates of sections, and this as long as the honey season seems to warrant. That is, from experience we know about what date the honey-flow, say from clover, usually ceases, and we take care not to give more accommodation than is likely to be made use of.

This is important when finished comb honey is wanted, though of little consequence if extracted honey is the object. The latter can be taken at the close of the season, whether in full-finished combs or not.

Securing well-ripened Honey.—To get either extracted or comb honey well ripened and sealed, we require at least two upper storeys or two crates of sections to each hive. As soon as the first put on is well forward, and the bees need more room, we raise it, placing the empty one between. If the latter have foundation only, the bees are compelled to store all their honey for a day or more in the upper story, which generally ensures its being well finished.

Produce.—Towards the close of the season we place the empty tier uppermost, as the other has more chance of being finished off when left next the brood-nest. By careful calculation, and with favourable weather, we thus get from good stocks from 50 lb. to 100 lb., and often more, of nice comb honey each, and from others 150 lb. to 200 lb. of extracted honey.

For details of how to manipulate the bees and combs when harvesting the honey, or of using the extractor, and preparing the honey for show or market, and for other minute matters, the reader must seek in books and journals specially dealing with bees.

Autumn Management.

In many districts the autumn treatment includes part of the honey harvest —viz., the heather.

Heather Honey.—Usually a week or ten days intervene between the close of the clover season and the time that heather yields. Where this most magnificent of all honey is to be had, special pains must be taken to secure it.

The secret is, barring the weather, to have only strong stocks, and to make them warmer by soft coverings than during the earlier season. Where swarming has been allowed *ad libitum*, neither swarms nor old stocks are fit to do much in the way of surplus. Stocks previously worked for extracting are best of all. They have always more bees left than those which have been worked for comb.

There should be some change in the plan of working these—that is, comb honey only should be sought from heather. Heather honey will not leave the combs in the extractor, but has to be broken up and pressed; nor does it sell so well as in the comb.

There should be no more room given than the bees can crowd comfortably into, as the nights are chilly, causing them sometimes to desert the supers.

After Honey Harvest.—The general autumn treatment for stocks after the honey harvest consists mainly in doing

all one can to keep the bees quiet, and so prevent robbing.

Bees Plundering. — Not a drop of honey or bit of comb should be left anywhere within their reach, for if once started, the bees get on at once for plunder; and so vicious do they then become, that the apiary is a place to be dreaded by man and beast. As soon as all surplus honey is taken, and that under every precaution, all hives should be closely though not warmly covered, doorways contracted a little, and left alone till early winter.

Necessary operations should be done towards evening, when flying bees have all gone home. If food be needed, either as a result of a poor season, or of the honey having nearly all been stored in supers, it should be given rapidly as soon as the supers are taken away, and before the time of dearth and robbery has come.

Queenless stocks should be attended to, weak hives united till strong, and all left to settle till the time for winter treatment arrives.

Food for Bees.

Liquid Food for Bees. — Boil together 5 lb. white sugar and 1 quart of water; a few minutes' boiling will suffice. It is improved by boiling with it a pinch of cream of tartar. This is the proper food for autumn. Spring food may have a half more water, and the tartar omitted.

Sugar-cake for Bees in Winter.— Boil together 5 lb. white sugar, less than a pint of water, and a pinch of cream of tartar, until a drop cooled on a plate stiffens so as to draw out as a thread. Take off the fire and set in a cool place, or in cold water, stirring briskly until the mass begins to cool and turns white and thick. Then pour out on thin sheets of paper laid in flat dinner-plates. When cold, the cakes should be white and firm, yet not hard.

Spring Food.—For early spring food, a handful of flour for each pound of sugar may be stirred in shortly before pouring out. These cakes should be slipped under the quilts, paper side up.

SHEEP-DOGS.

The collie dog is well entitled to mention amongst the live stock of the farm. He is a faithful and worthy servant, absolutely essential upon sheep farms.

Origin of Collies. — The origin of collies is not very clear. Darwin has stated that the type approximates more closely to the old feral type than does any other of the domesticated varieties of dogs. But it is extremely probable that the collie as we know it to-day is a created race, although the work of moulding the different types must have taken place very early—before probably some of our other breeds of dogs were much known, or even in existence.

The name Collie is believed by many to have been derived from the association of the dogs with certain Highland sheep which were known at one time as colleys on account of the black colour of their faces and legs. Others have held that Collie is simply a variation of the words Cooly, Colley, or Coley, signifying "black." Webster, in his dictionary, gives the derivation as from the Gaelic *cuilean*, a whelp, puppy, or dog.

Whatever may be the exact significance of the name, there is little doubt that collies in the early days of their history were specially associated with Scotland. Even yet in many parts of England it is customary to hear collies spoken of as Scotch collies, in contradistinction to the Old English sheep-dog, sometimes also called the hob-tailed dog, on account of his short, stumpy tail. Collies now hold, with fox-terriers, the distinction of being the most widely distributed breed of dogs that we have. In addition to the large numbers that are kept and used on farms, and by herds and drovers, many collies are now kept for fancy purposes and as pets.

VARIETIES OF COLLIES.

Broadly speaking, there are three varieties of collies—rough-coated dogs, smooth-coated dogs, and bearded dogs. If one included the Old English dog already referred to, which is well entitled to be included amongst sheep dogs, there would be four. Practically all of the different kinds of collies or sheep-dogs which one sees up and down the country, both in England and Scotland, as well as in Ireland, are bred from one or other of these types, or a mixture of them.

Bearded Collies.—Of the three first-mentioned varieties the beardie is perhaps as distinct a type as any. This class of dog is a sort of combination of the ordinary collie and the Old English sheep-dog. Beardies are nearly always dark or hazel grey in colour, roughly haired over the upper part of the face and eyes, and rather pronounced in the hook of the hind leg. This class of dog is very intelligent, but some years ago, on account of their generally bigger size and heavier weight, they became less popular with hill shepherds than the smaller class of collies. This, however, was followed by efforts for their reintroduction which have been attended with a considerable amount of success, and one now sees more of them than formerly. It is a tribute to the beardie that he is often seen in the hands of drovers—a class of men who waste little sentiment, as a rule, on their dogs, but usually put points of utility and usefulness in the forefront. From the point of view of the hill shepherd, however, the smaller collie has its advantages. Being lighter in weight, its feet are not so apt to get torn or frayed by rough heather roots or stumps.

A good specimen of a Bearded Collie is represented in fig. 735.

Smooth- and Rough-coated Collies.—Although they differ in their coats, the other two classes of collies mentioned have many points in common. They are made pretty much after the same model, are equally varied in colour, and have the same general cast of features. In recent times the rough-coated class have been to a large extent spoiled for work through the crossing which has taken place for fancy showyard points. A long sharp nose and a narrow contracted forehead has been practically the be-all and end-all with fancy breeders, the result being that much of the old intelligence of the dogs has been lost.

Fig. 735.—*Bearded collie.*

On this account, for practical purposes, many prefer the smooth-coated breed which has not been crossed to the same extent, or a cross between the smooth- and the rough-coated varieties. Many of the smooth-coated dogs are exceedingly valuable either for hill or field work. They are usually much more cautious than the rough-coated dogs and

Fig. 736.—*Smooth-coated collie.*

are easier trained, but are not, as a rule, so swift when a special spurt is required. In fig. 736 a portrait is given of Mr Robert Chapman's famous smooth-coated bitch "Young Trim." A modern representative of the rough-coated type is shown in fig. 737.

Rough-coated dogs, like dogs of the smooth-coated type, may be of almost any colour or combination of colours, although, as a rule, they are black and

white, black and tan, and black and tan and white, or variations of these. Sable has for several years been a popular colour in the case of "fancy" (show) collies, but few of these are to be met with in the possession of shepherds or farmers who keep collies for working purposes.

Old English Sheep-Dogs.—The bob-tailed dog, as he is frequently called, is not the least handsome of the four varieties. He makes a first-class companion, and by many is even preferred to the ordinary collie for working purposes. Indeed, on account of his sagacity and utility, he is often spoken of as the Smithfield or Drover's dog. Some people hold that the bearded collie of Scotland is a cross between the Old

Fig. 737.—*Rough-coated collie.*

English sheep-dog and the ordinary collie. In both the head is squarish, in place of being long and narrow, as in the case of the ordinary collie. The two types are certainly different, in respect that the one has a long tail and the other a short tail, but in most other respects they are not greatly dissimilar.

The colour most sought after in the English dog is some shade of blue or grey, with white markings. In many specimens the white predominates, but grey, grizzly blue, or blue merle, with or without white markings, are typical colours. The coat in both this and the bearded variety must be abundant, hard in texture, and shaggy, without, however, any great tendency to curliness. The under coat—this, however, applies to collies of all classes—must be very dense and waterproof. The usual height of a bob-tailed dog at the shoulder is about 22 inches; bitches measure, as a rule, about 20 inches. The short tail and shaggy coat of an English sheep-dog gives him a distinctly bear-like appearance, and makes him easily identified wherever seen.

Other Kinds of Collies.—In late years two or three more or less distinct types of collies have been evolved by selection from particular specimens. One of the best known of these is the marled or marbled collie of Wales and different counties of England. This is a bluish-coloured dog, very much after the type of an ordinary smooth-coated collie, but much more mixed in colour. The best specimens are very good workers, and Welsh shepherds use them largely in their daily avocations.

In the same way in late years, in the south-east of Scotland and northern districts of England, shepherds have produced what is practically a distinct breed. This is a medium-sized black and white dog, with sharp, pricked ears, and a rough rather than smooth coat. These dogs are specially bred and trained for sheep-herding purposes, and are greatly valued by those who own them.

Training Dogs.

Bad Training of Dogs.—The natural temper of the shepherd may be learned from the way in which he works his dog among the sheep. When an aged dog is observed making a great noise, bustling about in an impatient manner, running fiercely at a sheep and turning it quickly, and biting at its ears or legs, it may safely be assumed that the shepherd who owns it is a man of hasty temper. Most young dogs exhibit these characteristics naturally, but it is the business of a competent man to curb them and not allow the dog to do as he pleases. A man who allows his dog to deal with the sheep in the manner described is culpably careless of his flock. If, on the other hand, a shepherd be observed allowing his dog, whether old or young, to take a range round the fences of a field, driving the sheep as if to gather them, it may be concluded that he is a lazy fellow, more ready to make his dog bring the sheep to him than to walk his rounds to see them.

Great harm may accrue to sheep by working dogs in these ways. Whenever sheep hear a dog bark that is accustomed to hound them every day, they will instantly start from their grazing, gather together, and run to the farthest fence, and a good while may elapse ere they settle again. And even when sheep are gathered, a dog of high travel, and allowed to run out, will drive them hither and thither, without an apparent object. This is a trick practised by lazy herds every morning when they first see their flock, and every evening before they take up their quarters for the night, in order to count them with what they deem to be the least trouble to themselves.

When an imperfectly trained dog is allowed to run far out, it gets beyond the control of the shepherd; and such a style of working among sheep of any class puts them past their feeding for a time: with ewes it is very apt to cause abortion; and with lambs, after they are weaned, it is apt to overheat them and induce palpitation and high breathing. Whenever a sorting takes place among sheep, with such a dog they will be moved about far more than is necessary; and intimidated sheep, when run into a corner, are far more liable to break off than those treated in a gentle manner.

Judicious Training.—A judicious herd works his dog in quite a different manner. He never disturbs the sheep when he takes his rounds amongst them at morning, noon, and night—his dog following at his heel as if he had nothing to do, but ready to fulfil its duty should any untoward circumstance arise, such as breaking out of one field into another. When he gathers sheep for sorting, or catching a particular one, the gathering is made in a corner, to gain which he will give the sheep plenty of time, making the dog wear to the right and left, to direct the sheep quietly to the spot; and after they are gathered, he makes the dog watch, and, with an occasional movement, prevent any sheep breaking away. When a sheep does break away, and must be turned, he does not allow the dog to bite it, or even to bark, but to circle well in front of it and thus turn it back. Some single sheep are very obstinate to turn, and in such a case a snap by the dog at the animal's ear may be justified, but unless in extreme cases "teething" of the sheep ought to be forbidden.

A thoroughly good shepherd only lets his dog work when its services are actually required, he bestowing his own labours ungrudgingly, and only demanding assistance from his dog when he cannot do it so well by himself. At no time will he allow his dog to go beyond the reach of his immediate control.

Well-trained Dogs.—Dogs, thus gently and cautiously trained, become very sagacious, and will diligently visit every part of a field where sheep are most apt to stray, and where danger is most to be apprehended—such as a weak part of a fence, water-runs, deep ditches, or deep furrows into which sheep may possibly fall and lie *awalt* or *awkward*—on the broad of their back, unable to get up. Many dogs are so sagacious as to assist in raising up sheep lying awalt by seizing the wool at one side and pulling with all their power till the sheep get upon their feet.

Experienced dogs also know when foxes are on the move, and give evident symptoms of uneasiness on their approach to the lambing-ground. They also hear footsteps of strange persons and animals at a considerable distance at night, and announce their approach by unequivocal signs of uneasiness. A shepherd's dog when at active work is incorruptible, cannot be bribed with a bite of food, and will not permit even a known friend to touch it or its charge when intrusted with an act of duty.

Skill in Training.—Most shepherds profess to train young collies. In this delicate work many shepherds display little knowledge of the nature of the breed, and of the aptitude of the particular individual for its peculiar work. Hence many dogs are rendered unfit for useful service. Every collie-pup has a natural instinct for work amongst sheep; nevertheless, they should be trained with an old dog. Their ardent temperament requires subduing, and there is no more effectual way of doing this than by keeping them in company with an experienced dog. A long string attached to the pup's neck, in the hands of the shepherd, is necessary to make it become acquainted with the language of the various evolu-

tions connected with work. With this contrivance it may learn to "*hold away out by*," "*come in*," "*come in behind*," "*lie down*," "*be quiet*," "*bark*," "*get over the dyke*," "*wear*," "*heel*," "*kep*." It will learn all these terms, and others, in a short time. It is said that the bitch is more acute in learning than the dog, though the dog will bear the greater fatigue. Of the two, the quietly disposed shepherd prefers the bitch as a rule, and is chary of working her when in pup.

Sagacity of the Collie.

Much may be said of the sagacity and faithfulness of the collie. "If he be but with his master," observes Youatt, "he lies content, indifferent to any surrounding object, seemingly half asleep and half awake, rarely mingling with his kind, rarely courting, and generally shrinking from, the notice of a stranger. But the moment duty calls, his sleepy listless eye becomes brightened, he eagerly gazes on his master, inquires and comprehends all he has to do, and, springing up, gives himself to the discharge of his duty with a sagacity and fidelity and devotion too rarely equalled even by man himself."

"If we consider," says Buffon, "that this animal is superior in instinct to all others; that he has a decided character, in which education has comparatively little share; that he is the only animal born perfectly trained for the service of others; that, guided by natural powers alone, he applies himself to the care of our flocks — a duty which he executes with singular assiduity, vigilance, and fidelity; that he conducts them with an admirable intelligence, which is a part and portion of himself; that his sagacity astonishes at the same time that it gives repose to his master, while it requires great time and trouble to instruct other dogs for the purposes to which they are destined,—if we reflect on these facts, we shall be confirmed in the opinion that the shepherd's dog is the true dog of nature, the stock and model of his species."

The Ettrick Shepherd truly says that "a single shepherd and his dog will accomplish more, in gathering a flock of sheep from a Highland farm, than seventy shepherds could do without dogs; in fact, that, without this docile animal, the pastoral life would be a blank. It would require more hands to manage a flock of sheep, gather them from the hills, force them into houses and folds, and drive them to markets, than the profits of the whole flock would be capable of maintaining. Well may the shepherd feel an interest in his dog: he it is indeed that earns the family bread, of which he is himself, for the smallest morsel, always grateful and always ready to exert his utmost abilities in his master's interests. Neither hunger, fatigue, nor the worst of treatment will drive him from his side, and he will follow him through every hardship without murmur or repining."

Dog Trials.

Notably since the advent of the twentieth century, competitive trials for working collies have become an interesting feature in many rural districts. Prizes are given for the best working dogs over a stated course. Three or more sheep are usually penned in the distance, but in sight of the shepherd competitor. The sheep are liberated when the competitor takes his stand at the appointed place, and the dog has then to be run out and bring them to his master. Stakes are frequently erected through which the sheep have to be passed in a stated way. One or two of the sheep have usually to be separated from the others and held close at hand for a stated time by the dog. Finally the whole of the sheep have to be penned, the shepherd being permitted to assist the dog in this operation. Otherwise he is supposed to direct the dog only by words, signs, or whistles. The prizes are awarded not only on a basis of time, but on the exactitude with which the different operations are performed and the general behaviour of the dog, rough usage of the sheep being an almost fatal fault.

These trials are objected to by many sheep-farmers, on the grounds that the operations performed at the trials are not such as are met with in ordinary sheep-farming practice, and that a good deal of harm is inflicted upon considerable numbers of sheep by excessive driving in the process of training the dogs for the competitions.

VARIETIES OF FOOD.

The farmers of the United Kingdom have ample choice of materials for the feeding of their different classes of stock. A fairly substantial home supply is augmented by ever-increasing imports of moderately priced foods of good quality from colonial and foreign countries, and in order that farmers may be assisted in deciding from time to time as to the kinds of food which, at the current prices, can be most economically employed, full information is here presented as to the composition and character of the feeding-stuffs available in this country.

Brief notes regarding the different materials used as food for farm live-stock are given here. Detailed analyses will be found on page 290.

Milk.

Milk has a good right to rank first amongst foods. It is the most perfect and most natural of all foods for young animals. As already observed, there must be a proper mixture of the nitrogenous constituents or albuminoids along with the non-nitrogenous (carbo-hydrates and fat), to form a perfect food. A perfect illustration of this mixture is found in milk, the first food upon which the young animal is expected to subsist. It contains, 1st, casein or curd, which is a substance of the same class as the *fibrin* or lean part of the flesh; 2nd, fat in the shape of butter; 3rd, sugar, the most easily digested of all carbohydrates; and 4th, certain substances which are converted into the earthy part of the bones, and the saline matter of the blood. The saline or earthy portion of milk consists of the phosphates of lime, magnesia, and iron, chloride of potassium, and common salt.

In its ordinary state the milk of the cow consists on the average of about 3½ per cent of casein or flesh-forming matter, 3½ per cent of butter-fat; 4½ per cent of sugar; ¾ per cent of saline matter; and 87¾ per cent of water. Everything, therefore, which is required to promote the development of the growing animal is contained in the milk, blended together in proportions suited for the purpose.

Wheat.

Wheat is a very starchy food. In the form of flour it is not suitable for stock; but as it leaves the straw with the bran and other coats, it is a fairly well-balanced food, coming pretty near to the albuminoid ratio of 1 to 7.

Damaged Wheat for Stock.—Wheat which has been damaged by wet in harvesting is sometimes turned to good account in feeding stock. It should be first kiln-dried and then mixed with chaffed hay or straw.

Feeding Value of Wheat.—When wheat was selling at from 40s. upwards per quarter, it was too expensive to be used in feeding stock; but when it sells at not more than about 30s. per quarter, it may in some cases be employed for this purpose with advantage. Mr John Speir, Newton Farm, Newton, Glasgow, has used wheat with very satisfactory results in the feeding of dairy-cows. He points out, however, that to be a successful feeding-stuff by itself it would require much more oil than it possesses, and considers that the addition of one-fourth of linseed or one-third of linseed-cake would much enhance its feeding value. He says that to cattle—mixed with an equal proportion of decorticated cotton-cake and peas or beans, all ground into rough meal (not flour)—it has given excellent results. It is better boiled and given whole than ground into flour, but as rough meal it is better than either, as then it never gets into the doughy state, and it mixes freely with chaff and pressed or sliced turnips.

Wheat for Sheep.—Experiments conducted by the Royal Agricultural Society of England at Woburn showed wheat in a favourable light. It was tried along with linseed-cake, decorticated cotton-cake, and barley. The best results were got from decorticated cotton-cake, wheat coming next. The wheat was given whole.

Bran.

Bran, which in milling wheat for use as human food is usually separated from the flour, is much used as food for live-stock. It is sometimes given in the form of mashes, and at other times mixed with other kinds of foods. When used by itself, or mixed with cold water, it has a slightly laxative effect, which renders it useful in preparing horses for physic, and in some cases may so act as to obviate the necessity of giving purgative medicine. The ash of bran contains a large proportion of phosphates, much larger than the ash of barley or oats. Hence it is particularly useful as part of the food given to milch cows, when such are "in profit," or full milk—milk being rich in phosphatic constituents.

Bran acts beneficially in counteracting the heating properties of maize and other similar meals.

Barley.

Barley is exceedingly rich in the fattening constituents of food. It is seldom —and never should be—given in its dry whole state as food for stock; but in the form of rough meal, or cooked, it is fed very extensively. Like wheat, it has fallen in price, and its home consumption has increased proportionately.

Cooked Barley. — When barley is being cooked, it must be allowed to simmer slowly twelve hours, until the whole forms a mass of rich pulpy matter, perfectly free from whole grains. The greatest care must be taken to prevent the barley from becoming burned, by adhering to the boiler in which it is prepared. When thoroughly cooked, it becomes a most valuable ingredient in the food of fattening animals. Horses thrive remarkably well upon it—so much so, that a course of boiled barley given at least once a-day will very soon renovate horses that have been worn out with hard work.

Boiled barley is used by some of the most successful exhibitors of Shorthorns in the preparation of their cattle for the showyards. Along with a little oilcake, it gives that finish—brings out that mellowness in handling—which is so much desired in such cases.

Steeping Barley. — Whole barley should be steeped in water at least twenty-four hours before being given to stock; but the more common practice now is to grind it or to crush it into rough meal. Some think it advisable to steep the ground barley in water.

Malt.

Barley is converted into *malt* by being first steeped and then allowed to germinate, the original object of this process being to prepare the barley for distillers and brewers. As to the simple question of the relative feeding merits of *malted* and *unmalted* barley, there was a lively and long-continued controversy. Formerly the duty now levied directly upon manufactured spirits, ales, and porters was imposed upon malt, and then farmers could not malt barley for feeding stock without paying the malt-duty. This was a momentous grievance to farmers, on whose behalf it was urged that malt was much more valuable as food for stock than unmalted barley. Human nature is a little curious in some of its moods, and it is just possible that the barrier which formerly existed to the use of malt as food for stock may have had something to do with the high opinion then expressed as to its value for that purpose. Be that as it may, the duty was removed from the malt, and now that farmers can make malt for their stock as freely as they desire, much less is heard of its alleged special feeding virtues than when they had no such liberty. Indeed, malt has almost entirely ceased to be used as food.

That malt is a valuable and palatable food there is no doubt whatever. The contention that it is superior food to unmalted barley has not been borne out by practical experience.

Rothamsted Experiments with Malt.—Sir John Bennett Lawes carried out an elaborate series of experiments upon the use of malt in feeding various kinds of stock. In all these experiments he compared a certain weight of barley with the same weight of barley converted into malt. Given to cows, he found that the same quantity of milk was produced, but the quality was better with unmalted barley. In a feeding experiment with twenty cattle, the ten getting unmalted barley increased more in weight and were

more even in condition than the ten which got malt. In his experiments on sheep and pigs, the results were also rather in favour of the barley unmalted.

Special Properties of Malt.—It has, however, been proved that malt does possess certain useful properties in the feeding of stock which are not possessed to the same extent by unmalted barley. The late Mr Richard Booth, of Warlaby, considered that malt was superior to any other article for feeding cattle up to the very "tip-top" condition to which they require to be brought when they are intended for the showyard. Malt has been used with good results in rearing young pure-bred bulls.

The truth probably is, that such special value as malt possesses is to a great extent a *condimentary* value. Just as cattle-spices are valuable for imparting a relish to diets in which straw-chaff or poor hay predominates, so malt, owing to its sweet and appetising flavour, may impart a relish to food that may be of value.

But it by no means follows that a food which best puts the finishing touches on an abnormally fat animal (which is rarely produced at a profit) is to be regarded as, on that account, an economical article of diet for profitable meat-production. As a matter of fact, the balance of evidence is in the opposite direction, and is confirmed by so little being heard of the use of malt for commercial animals in recent years.

It usually costs close on 2s. per quarter to convert barley into malt.

Malt-combs.

When barley is converted into malt, the effect of the steeping process is to cause the grain to throw out young shoots, just as the seed does when put in the soil. These young shoots are afterwards separated from the malt, and are known as "*malt-combs*," or "*cummins*," or "*malt-dust*." The combs are used as feeding-stuff, and have been found useful, along with other articles, as food for milch cows. Sir Charles Cameron says that the composition of this food indicates a high nutritive power, but adds that it is probable that its nitrogenous matters are partly in a low degree of elaboration, which greatly detracts from its alimental value.

Malt-combs for Cows.—The late Dr A. Voelcker considered that malt-combs possessed high milk-producing qualities, and that the food might be given with great benefit to dairy-cows.[1]

Malt-combs as Manure.—Malt-combs are also used as manure, but the late Dr A. Voelcker considered it wasteful to apply them directly to the land; they should first be passed through the animal's body.

Bere and Rye.

In feeding value these are very similar, but slightly inferior, to barley. Rye is generally used in this country in a green state when given to cattle. The grain is useful for feeding purposes, although somewhat inferior to barley.

Rye-meal is given with advantage to milch cows.

Brewers' and Distillers' Grains.

Brewers' grains, or "draff" as the article is called in some parts, consists of the refuse malt after it has undergone mashing. The grains left in the distillation of spirits are usually slightly richer than those left in brewing ale or porter. Both are now very extensively used as food for different classes of stock, and the results are, on the whole, very satisfactory.

Dried Grains.—A process of preparing grains by drying and other modes of manipulation has been invented, and the article so prepared is sold under the name of "Dried Grains." The grains in this state are more concentrated than they are in the ordinary state, and may be given to all kinds of live-stock. For horses it is a frequent custom to substitute at first 3 lb. of grains for 3 lb. of oats, and increase the proportion until half the feed is composed of grains. For cattle the grains may be mixed with other food, and should be damped where oilcake is used. The animals should be supplied with water when equal parts of grain and cake are used. For cows it is usual to damp the grains with boiling water, and allow them to swell; 8 to 12 lb. per day may be given. To sheep the grains may be given alone, or with an equal weight of corn or cake. For pigs,

[1] *Jour. Royal Agric. Soc. Eng.*, xiv. 248.

damp well with boiling water as much as will be required for a day's use.

Dried *v.* Wet Grains.—A ton of dried grains would be equal to between three and four times its weight of wet grains. The drying chiefly effects economy in carriage. But when a brewery or distillery is within easy reach, it is, of course, more economical to use wet grains than the artificially dried, and therefore somewhat more costly, article.

Grains for Dairy-cows.—Grains are a particularly favourite food with cow-keepers, as they produce a large flow of milk—more remarkable, however, for its abundance than its richness, that is, where grains are the preponderating food. When mixed with a fair proportion of other richer concentrated food, such as cake or grain, the grains form an admirable article of diet for cows in milk.

Difference in Composition.—The average of the analyses of a large number of samples of the two varieties, conducted in the Edinburgh College of Agriculture (1908), gave the percentage of oil in distillery grains as 5.96 and in brewers' grains as 4.99, the percentage of nitrogenous matter as 18.75 and 20.61 respectively, and the percentage of soluble carbohydrates as 54.37 and 48.85 respectively. In price the distillery grains are usually higher in comparison with brewers' grains than the difference in analyses would seem to justify.

Other Distillery Food.—Useful feeding material is found in other distillery by-products, such as the "wash" or "burnt ale" of malt distilleries and the "dreg" of the raw grain distilleries.

Oats.

No other variety of grain is so extensively used in this country as food for live-stock as are oats. And in the form of meal it is a very wholesome food for man, still used very largely—but not so extensively as in former times—in Scotland. It was Dr Johnson who described oats as "the food of men in Scotland, and horses in England." It was probably a Scotchman who retorted,—"Ay; and where will you find such men and such horses?"

Oats are highly favourable to the formation of muscle. Their nutritive value, however, is by no means regular, some varieties being one-third more nutritive than other kinds.

Bruising Oats.—Oats ought generally to be bruised before being given to animals, as the food then becomes not only more thoroughly masticated, but also much less liable to produce inflammatory action, which sometimes arises from the over-liberal or inconsiderate use of the whole grain.

Nutriment in Oatmeal.—In the form of meal it is seldom used as cattle-food, except as nourishing drinks or gruel; but when ground into meal, the more thoroughly it is sifted the more nutritious it becomes. This is exactly the reverse of what takes place in the case of wheat-flour, because a large proportion of the flesh-forming and also of the fat-forming substances contained in wheat is removed in the bran. In fine oatmeal there is much more oil than in fine wheat-flour, and in the former one and a half times as much albuminoids as in the latter.

There is no need to enlarge here upon the merits of a food which is so generally esteemed for this purpose as oats are.

Indian Corn.

The prevailing cheapness and high nutritive properties of Indian corn or maize have brought it into extensive use as food for farm live stock.

This food is very rich in starchy matters. Given by itself, or in large proportions, it has a heating and binding tendency; but it does well with other foods, such as linseed-cake. On the whole, maize is usually about the cheapest form in which starch for feeding purposes can be purchased in this country, and it is therefore one of the most extensively employed articles of food for all kinds of farm live-stock, including poultry. For all stock except poultry maize should be bruised or kibbled.

Buckwheat.

This plant is comparatively little grown in this country, being easily susceptible of injury from frost, especially if the seed is sown earlier than the middle of May. The crop is sometimes cut green, and used for soiling. The grain is used chiefly for feeding game or poultry.

In Ireland the term "buckwheat" is sometimes locally applied to some of the varieties of common wheat, with which the true buckwheat has no connection.

Rice.

Rice is sometimes used as food for poultry, and is of a very fattening nature. It is exceptionally high in starchy matter.

Rice-meal.

Much more important than rice, as a feeding-stuff, is the so-called "*rice-meal*," which consists of the ground refuse left after dressing or trimming rice for human food. This rice-meal consists mainly of the coating of the reed (or bran), with more or less of the adherent starchy matter.

Rice-meal contains a fair quantity of albuminoids, and is rich in oil, and is in much request for pig-feeding. It is also used as food for cattle, and the experience of it has, on the whole, been satisfactory. Mr Garrett Taylor, Trowse House, Norwich, has used it largely both for dairy-cows and young store-cattle, and he speaks of it very favourably.

Care should be taken to obtain the genuine article, as this food is sometimes adulterated with ground rice shudes—the outer husks of the rice—which have very little nutritive value, but consist mainly of a silicious woody fibre.

Dari or Durra.

This is the seed of the plant called Indian millet or Guinea corn, which is largely cultivated in India, China, Africa, Italy, the West Indies, &c., where it is used for feeding horses, pigs, and poultry. It weighs upwards of 60 lb. a bushel, is of the size of a large millet-seed, is covered with a husk or envelope, and gives, when crushed, a beautiful white flour.

Ground into meal, this grain is an excellent fattening food for cattle. Dr Voelcker remarked: "It contains an appreciable amount of ready-made fat, and a large proportion of starch, which is with ease transformed into fat in the animal economy; but it is rather deficient in albuminoids, and for this reason Dari meal should be given to stock in conjunction with cake, beans, or peas, or, speaking generally, with food rich in albuminous compounds."[1]

Dari grain is also good food for poultry.

Beans, Peas, and Lentils.

These leguminous plants closely resemble each other in their composition. From their nature they are better suited to be used as a portion of the food of working or growing animals or milch cows, than of those which are being fattened for the butcher. At the same time, when used along with other kinds of food, particularly such as are of an oily nature, they may be given with much advantage to fattening stock. Lentils are chiefly imported, but they may be profitably grown in this country on light, dry, sandy, or calcareous soils.

Vegetable Casein.—It is worthy of note that the albuminoids in these three seeds (and also in other leguminous seeds) are in a form somewhat similar with the casein of milk, and hence termed "vegetable casein." It is on this account that meals made from these seeds form useful ingredients in mixtures for calves.

Beans for Dairy-cows.—Bean-meal is by many recognised authorities assigned the very highest position as an article of diet for dairy-cows. Mr John Speir, Newton Farm, Newton, Glasgow, gave it as his opinion that "for the production of butter or cheese of the best quality, no other feeding-stuff ever gained or so long maintained so high a reputation as beans"; and he adds, "They are also very palatable to all stock of the horse, sheep, and cow kind, although swine are not so fond of them."

Beans, like the other leading leguminous foods, have a high albuminoid ratio, and, therefore, are well suited for mixing with other foods rich in carbohydrates, such as turnips, potatoes, oats, rice, straw, and hay.

Mr Primrose M'Connell says that "beans have made a name for themselves as food for dairy-cows, but prices and handiness make it more desirable to use something else." He adds that he gives his cows a mixture of crushed beans, oats, and bran.

[1] *Jour. Royal Agric. Soc. Eng.*, xiv. 247.

Preparing Beans as Food.—Beans should invariably be ground into rough meal before being given to stock, but should not, as is sometimes done, be steeped in water before being mixed with the other foods, as then, on account of its highly albuminous nature, the meal is apt to get into a doughy, indigestible mass. Bean-meal holds the premier place as a milk-producer; but being so highly albuminous, it requires to be mixed with some more bulky food in order to keep its particles apart, and allow the juices of the stomach and intestines to dissolve them. Mixed with cut hay or straw, the meal becomes one homogeneous mass of such a porous nature that each atom of its constituents can separately be attacked by the juices of the digestive organs; whereas if mixed in water alone, the bulk of it is voided undigested, if it does not also produce indigestion by the way.

Soy Beans.—The Soy bean (*Soya hispida*) is a leguminous plant extensively cultivated in China, Japan, and Manchuria, where it is an important article of human food. Large quantities of the bean are now coming to this country, where it is used as an oil seed, most of the oil being expressed, and the remaining cake is a valuable addition to our cattle foods. The Soy cake is a highly concentrated food, equalled in richness in albuminoids only by decorticated cotton-cake and decorticated earthnut-cake. There is little starch in Soy beans. Being so exceptionally rich in albuminoids, Soy beans are best suited for use in mixed foods.

Peas for Sheep.—Peas are capital food for sheep—along with linseed-cake there is perhaps no better as a concentrated food. In a series of experiments conducted at Woburn by the Royal Agricultural Society of England, pea-meal was contrasted with barley-meal and malt as food for sheep, each along with turnips, hay and straw, chaff and linseed-cake. In summing up the results, which were favourable to the pea-meal, Dr A. Voelcker stated that "linseed-cake and pea-meal in equal proportions, and used at the rate of ¼ lb. each per head per day, in conjunction with some hay and straw, chaff and swedes, given *ad libitum*, is a better food for young sheep than either a mixture of linseed-cake and barley-meal, or linseed-cake and malt."[1]

Poisonous Beans.—In the years 1905 and 1906 deaths occurring amongst dairy-cows in Scotland were attributed to eating Java beans (*Phaseolus lunatus*), which were found to contain prussic acid. The Java beans were ascertained to be the most dangerous, but traces of the poison were also observed in the Burma variety.[2]

There is a large variety of beans in existence, and great caution is necessary in using kinds not thoroughly well known.

Lupin.

The seeds of the lupin contain a larger proportion of flesh-forming substances than either beans or peas or lentils.

The cultivation of the plant is quite simple, and it grows well on poor, sandy, and gravelly soils. It is cultivated extensively in the northern parts of Germany, and it is grown to a small extent in England. The stems make excellent hay, and the seeds are found to be very superior food for sheep. They are also given to horses and cattle, mixed with oats or beans; and lupin-meal is given with milk to calves.

Linseed.

Linseed has not inaptly been described as the sheet-anchor of the stock-feeder. He is now less dependent upon it than when he first began to use concentrated foods extensively. But although many other useful articles of food for farm live-stock have been brought into notice in recent years—thanks in a large measure to the application of science to the question of economical stock-feeding—it is still true that for almost all classes of stock linseed is a feeding material of the highest value.

There are a great many varieties of linseed, some kinds being much richer than others. Linseed of fine quality, weighing 52 lb. per bushel, readily yields from 11 to 12 gallons of oil per quarter of 8 bushels, weighing 9 lb. per gallon, or about 25 per cent of its weight.

[1] *Jour. Royal Agric. Soc. Eng.*, xix. 430.
[2] *Trans. High. and Agric. Soc.*, 1907.

Preparing and using Linseed as Food.—Linseed is an exceedingly rich food, especially in oil. It is therefore not advisable to use it in its natural state, as, when so used, a considerable proportion of the seeds will be found to pass undigested. Being of a laxative nature, it requires to be used with caution, and in combination with other articles which have a counteracting effect.

The seed is sometimes boiled in order to prepare it for use as the food of animals, but a better mode of preparation is to grind it. When this is done, chaff, or the husks which are separated from oats in the process of milling, should be passed through along with the linseed, as either of these articles helps to prevent the linseed from "clogging" the millstones; and besides, they absorb a portion of the oil which exudes from the seed in the grinding, and thus they become useful articles of food, although they are of little value in their natural state.

Linseed chaff also makes excellent food.

Boiling Linseed.—Meal made of pure linseed may be given in combination with other kinds of food, such as bean-meal, barley-meal, Indian-meal, &c., but it is also frequently prepared for use by boiling. When the seed is prepared in this way, it is generally steeped for some hours in hot water and then boiled, but it is very apt to burn during the process of boiling unless it is carefully watched. In order to prevent burning, it has been found better to raise the water to the boiling-point before putting in the linseed, instead of putting the linseed into cold water and then boiling it. When the linseed is put into boiling water, add a little cold water, and then let it again come to the boil, and allow it to remain boiling for twenty minutes, stirring it occasionally.

Linseed for Calves. — Linseed-oil commands a price for other uses, which renders it too costly for fattening commercial stock. The cheaper residue of the crushers' trade—linseed-cake—contains sufficient oil for most feeding purposes, but for calf-rearing no kind of food surpasses linseed, and in conjunction with cheaper commodities, it is very largely employed for this purpose.

Growing Flax for Fibre and Seed.—As has been shown in another part of this work (vol. ii. p. 391), flax is grown extensively in the north of Ireland for the production of a fine class of fibre, which is incompatible with a large crop of seed. If the value of the seed as a fattening material were inculcated more strongly than it has been by those who advocate the extension of flax-cultivation, it is probable that flax-growing would be more largely practised throughout the kingdom than it is at present. As it is, this country has to depend upon foreign sources of supply for the linseed required for various purposes.

Linseed-cake.

Linseed-cake consists of what is left of the seed in the process of extracting linseed-oil. Formerly from 12 to 14 per cent of the oil usually remained in the cake; but the means now employed in extracting the oil do the work so efficiently that less oil is left, although linseed-cake with high percentages of oil can still be got.

High Reputation of Linseed-cake.—Enough oil still remains to impart great value to linseed-cake as feeding material. It is suited for all kinds of farm live-stock. For fattening cattle no other food has such a high reputation as the best home or Russian linseed-cake. In fact, owing to the consensus of practical opinion, it almost always commands a higher price than its analysis seems to justify. Horses become extremely fond of linseed-cake, and 3 lb. per day has been given to farm-horses with good effect.

Linseed-cake is crushed into small pieces before being given to stock.

The dung of cattle fed on linseed-cake is very rich, nearly half the weight of the ash of linseed-cake consisting of phosphate of lime; and one result of giving cake to cattle or sheep feeding on grass land during summer and autumn is to improve the pasture, besides hastening the fattening of the animals.

Storing Linseed-cake.—The late Dr A. Voelcker remarked — and this is a point of the very greatest importance —that "the nutritive value of feeding-cakes depends not merely upon their proximate composition, but likewise upon their physical condition. Like all

other perishable articles of food, linseed-cake, when kept in a damp or badly ventilated place, rapidly turns mouldy, and after some time becomes unfit for feeding purposes." [1]

Linseed-cake should be stored in as dry a place as can be found. The floor should be a wooden one if possible. If it be of plaster or concrete it is advisable to lay some old timbers on the floor, forming a stool, and pile the cakes in stacks thereon, about 8 or 10 inches from the walls, so that a current of air can get round. The cakes should be packed in such a way that the air can get through the pile and come in contact with all the edges of the cake.

The ventilation of the store should be good, and as much air as possible allowed to get inside when the atmosphere is dry, but the doors and windows should be closed when it is damp.

The same remarks are applicable to the storing of cotton-cakes, but these cakes do not keep well beyond a month or six weeks.

When good linseed-cakes, manufactured without the use of water, are stored in the manner thus described, they have been known to keep for 12 months without any appreciable deterioration.

Adulteration of Cakes.—Unfortunately, it has become so much the practice to adulterate cakes of all kinds in the process of manufacture, that the greatest caution is necessary in purchasing any article of the kind. Impurities also exist in the seed, varying from 1¾ per cent to 70 per cent; and these impurities are sometimes added artificially. Farmers are now well protected against loss in this way by the Fertilisers and Feeding Stuffs Acts, the provisions of which all purchasers of feeding-stuffs should study carefully.

Rape-cake.

Rape-cake, when pure, is a valuable food for cattle. In albuminoids it is richer than even the best of linseed-cakes.

It is not much relished by cattle at first, but if care is taken to prevent it from getting damp and mouldy they will take to it by degrees. If the animals refuse to eat it in its fresh state by itself, the difficulty may be got over by covering the cake for some time with sawdust, chaffed straw, or any substance that will prevent it from becoming damp or moulded.

Preparing Rape-cake for Cattle.—The cake is of course crushed, and it is of advantage to pour boiling water over the crushed cake, and allow the mixture to stand for a time before it is used. Steaming the cake along with chaffed straw is also a good mode of preparing it for cattle; and in so preparing it bean-meal or bran is added, in the proportion of 4 lb. of cake to 2 lb. of bran or 1 lb. of bean-meal. With these articles, 16 lb. of chaffed straw should be blended before steaming.

Impurity of Indian Rape-cake.—On account of the amount of wild mustard or charlock (*Sinapis arvensis*) it usually contains, it is not safe to use Indian rape-cake as food for stock. Dr A. Voelcker stated that from ¼ lb. of Indian rape-cake he obtained enough essential oil of mustard to convince him that half a cake of it, if not a smaller quantity, might kill a bullock.

Even the best rape, when mixed with linseed-cake, imparts a turnip-like flavour to the latter, which of course reduces its value.

Cotton-cake.

This cake is made from the seeds of the cotton-plant. There are two varieties of it in use—the decorticated, from which a portion of the husks has been removed, and the undecorticated, which contains the whole of the dark-brown husks of the seed.

As in the case of linseed-cake, the improvements in the crushing machinery have greatly reduced the percentage of oil in decorticated cotton-cake.

The decorticated variety is of a uniform yellow colour, while the presence of the dark-brown husks in the undecorticated at once indicates its nature.

Caution in using Undecorticated Cotton-cake.—The undecorticated variety is not only less valuable than the other, but it is also apt to produce inflammatory symptoms in the animals

[1] *Jour. Royal Agric. Soc. Eng.*, ix. 3.

fed upon it, and death has frequently been the result. This arises from the quantity of cotton which adheres to the seed, and from the harsh nature of the husk. Although undecorticated cotton-cake may be employed as food for cattle when used cautiously, it is generally safer to use the decorticated variety, which, as will be gathered from the analysis, is also superior as a feeding material.

In the eyes of graziers, the undecorticated cake has a special value owing to its astringent properties, which render it useful to obviate any scouring tendency amongst cattle or sheep when on young or luxuriant pasture.

Two varieties of undecorticated cake very extensively used are Egyptian and Bombay cake, each of which has well-known characters.

Uses of Decorticated Cotton-cake.—Decorticated cotton-cake is very rich in flesh-forming matters, as well as in phosphates, or "bone-formers," and is therefore specially adapted for growing stock and cows giving milk. For calves and lambs it is not so suitable—indeed, for these young animals it is somewhat dangerous—on account of its aptitude to give rise to digestive trouble. It should be given to them only in very small quantities.

Value of Undecorticated Cotton-cake.—Undecorticated cotton-cake has gone on gaining in public favour as an ingredient in feeding mixtures. Numerous experiments by Mr John Speir and others have shown its high value as a food for cows in butter-making herds, and for other classes of stock. In almost all fattening experiments it is put on trial, and almost invariably it gives a good account of itself.

Preparing Cotton-cake for Feeding.—Some think it better to have the cake ground into meal than merely broken by the usual cake-crusher. If the cake is to be merely crushed, it would be useful to have this done some time, perhaps ten or fourteen days, before giving it to cattle, so that it might absorb moisture, and thereby get softened and more easily digested.

It is important in buying undecorticated cotton-cake to avoid hard rock-like samples, and accept only cake that is oily and soft.

Manurial Value of Cotton-cake.—Cotton-cake imparts an exceptionally high value to the manure of the animals fed upon it. As will be shown presently, in dealing with the "Manurial Value of Foods," it stands above most other foods in this respect.

Palm-nut Meal.

Palm-nut meal is made from the cake which remains in pressing the oil out of the palm-nut. There are some very inferior kinds of palm-nut cake or meal in the market, and these have been used in adulterating linseed-cake—not so much lately, on account of the vigorous and commendable efforts that have been made to put down the adulteration of all feeding-stuffs as well as of manures.

Palm-nut meal has been found an admirable food for calves, but it is not extensively used. For calves it is prepared by being steeped in hot water. It is also well suited for cows in milk—increasing both the quantity and quality of the milk. It gives good results in feeding pigs, if used with such other foods as barley-meal, Indian meal, beans or peas. An equal mixture of palm-nut meal and decorticated cotton-cake is equivalent in feeding properties to linseed-cake, and considerably less in cost.

Cocoa-nut Cake.

Cocoa-nut cake is manufactured from the cocoa-nut palm. It is a wholesome food, and cattle take to it readily. It is, however, inferior to pure linseed-cake.

The ordinary cocoa-nibs, as sold by grocers, are occasionally employed as a feeding material for young calves. The nibs are boiled over a slow fire for two or three hours—6 or 8 quarts of water to 1 lb. of nibs. They are then strained out, and the liquid is mixed with milk and given to calves when it is milk-warm.

Minor Oilcakes.

Other cakes prepared from oil seeds of which a considerable amount is used are niger-cake, earthnut-cake, sunflower-cake, and hemp-cake. All of these are residues left after the corresponding seed is crushed for oil. Earthnut-cake is

specially rich in albuminoids. When it is made from the decorticated seed it surpasses even decorticated cotton-cake in this constituent. A considerable amount of it is made, however, with the husk only partially removed or not removed at all. When the husk or pod is crushed with the seed, the cake, like undecorticated cotton-cake, contains much fibre.

Cotton-cake, rape-cake, and all the minor oilcakes like earthnut-cake, niger-cake, cocoa-nut cake, poppy-seed cake, are much used in the preparation of compound or mixed cakes, which are now very common. Many cakes which are comparatively seldom used by farmers under their own names are largely used when made up into special compound cakes and meals.

Poppy-cake.

Poppy-cake must be used when quite fresh, as the oil is apt to become soon rancid. When fresh, it is a useful feeding material.

There are two varieties of poppy-cake,—one a light-coloured or whitish cake, made from white poppy; the other a dark or brownish cake, made from common poppy-seed.

Locust or Carob Beans.

These are the beans or pods of the locust-tree (*Ceratonia siliqua*). The locust-meal contains fully half its weight of sugar, but it is deficient in albuminous compounds or flesh-formers; consequently it should be given to stock in combination with peas or bean-meal, or with decorticated cotton-cake. The pods are either roughly crushed or ground into meal, and either way are much liked by cattle and sheep.

Molasses or Treacle.

Used with skill and care, treacle is an exceeding useful feeding commodity.

Treacle risky for Breeding Stock.—It is pretty generally believed that food excessively rich in saccharine matter, while highly valuable in the fattening of stock, is unsuitable for breeding animals, in that it tends to impair their procreative powers. About 60 per cent of the weight of molasses or treacle consist of sugar, so that it lies very specially under the above condemnation.

In his instructive paper on "The Reproductive Powers of Domesticated Animals" contributed to the *Journal of the Royal Agricultural Society of England*, the late Professor Tanner laid great stress upon the detrimental influence of "sugary" foods upon the reproductive powers, and considered it very doubtful if any stock which have been fed for a length of time upon food largely mixed with molasses ever regain their breeding powers.

These extreme views have not been universally accepted, but there is no doubt that the general drift of the contentions emphasised by Professor Tanner are well founded.

Useful Properties of Treacle.—Treacle possesses special properties of considerable value. Diluted with water, and sprinkled over layers of food-mixtures, it renders the material more palatable to the stock, and its laxative characteristic makes it a useful ingredient in many mixtures with an opposite tendency. Then its own intrinsic properties in laying on fat are very high; and therefore, properly and carefully employed, treacle is of considerable service to stock-owners.

Professor Tanner acknowledges the high fattening properties of treacle, and remarks that it has "the effect of suppressing these periodical returns of restlessness which prevent heifers feeding as well as steers"; and adds that, "whilst avoiding it for breeding animals, we may encourage its employment when cows or heifers have to be fattened."[1]

Treacle for Young Bulls.—There is no doubt that, in spite of all the warnings that have been given, treacle is still used extensively for breeding stock, notably in forcing young bulls and heifers into blooming condition for show or sale. It is included in the feeding mixture for young bulls in several of the leading herds of the day; but in almost all these cases there is a skilful hand at the helm, and the tasty but dangerous treacle is given sparingly and judiciously, so as to benefit the animals without impairing

[1] *Jour. Royal Agric. Soc. Eng.*, sec. ser., i. 267.

their fecundity. Unfortunately, there is too good reason to believe that in some cases harm is really being done to the breeding properties of young animals, bulls more largely than heifers, by the too liberal and imprudent use of treacle.

How Treacle is used.—Treacle is often given to sickly animals mixed with bran or gruel, and it is sometimes put amongst milk for calves. Owing to its highly laxative nature, from 2 lb. to 3 lb. per day is the most that can be given with advantage even to full-grown beasts, and from ¼ lb. to 1 lb. to a calf, according to the age of the animal. The late Dr R. Thomson of Glasgow found that about 3 lb. of molasses mixed with 9 lb. of barley-meal, and given along with 25 lb. to 30 lb. of hay, kept milch cows in full milk, and did nearly as well as 12 lb. of either linseed-cake or bean-meal. A few ounces per day, diluted with hot water, and sprinkled over the dry food of horses or of fattening sheep, will be found beneficial.

There are now on the market some prepared foods which contain a good deal of treacle, and for which it is claimed that they overcome its laxative and depressing qualities. These foods are well spoken of by many stock-owners, and are not so highly appreciated by others. Most experienced feeders prefer to mix their own foods, just as they think it best to mix their manures for themselves.

Turnips.

In the winter food of cattle and sheep roots bulk largely. To a smaller extent they are also used for horses and pigs. Turnips, with the swede as the chief variety, supply the largest proportion of this description of food.

Variation in Nutritive Value of Roots.—The nutritive value of turnips varies with the variety, the climate, soil, and also the manures used in their cultivation, so that any description of their constituent elements can be regarded as only an approximation to the truth, even in the case of the same kind of turnips if grown under different circumstances. All the varieties of the turnip contain a large percentage of water—namely, from 86 to 94 per cent, leaving only from 6 to 14 per cent of dry matter. Turnips grown in some parts of the kingdom, particularly in the north of Scotland, will, with the aid merely of fresh oat-straw, be found to fatten cattle without using much artificial food of any kind; whereas large quantities of cake and hay must be given along with the same kind of turnips to effect that object, when such turnips are grown in some other districts. This is more especially the case with turnips grown in the south and east of England.

Advantages of Storing Turnips.—Turnips become more nutritious after they have been stored for some time than they are when taken fresh from the field. By storing they lose a proportion of the water which they naturally contain; and there are also some chemical changes which take place in them tending to render them more nutritious.

When turnips are allowed to remain in the field until the leaves begin to put forth a fresh growth, as they will be found to do early in spring, a decided deterioration in their quality is the result, owing to certain of their elements becoming changed into indigestible woody fibre. Hence the necessity for storing turnips at the proper season, say in November and December.

Composition of Turnips.—The following table gives the average composition of five varieties of turnips, as deduced by Cameron from the results of the analyses of Anderson and Voelcker:—

	Swedes.	White Globe.	Aberdeen Yellow.	Purple-top Yellow.	Norfolk Turnip.
Water	89.460	90.430	90.578	91.200	92.280
Albuminoids	1.443	1.143	1.802	1.117	1.737
Sugar, &c.	5.932	5.457	4.622	4.436	2.962
Fibre	2.542	2.342	2.349	2.607	2.000
Ash	0.623	0.628	0.649	0.640	1.021
	100.000	100.000	100.000	100.000	100.000

The means of the analyses of 60 differently grown lots of roots, numbering in all nearly 3000 bulbs of Fosterton hybrid turnips, gave the late Dr Aitken[1] the following results on soils at Pumpherston and Harelaw respectively:—

	Pumpherston.	Harelaw.
Water . .	91.3	92.6
Dry matter	8.7	7.4
	100.0	100.0

Composition of dry matter:—

Albumen .	7.7	7.5
Fibre . . .	10.8	11.7
Ash . . .	5.8	6.4
Carbohydrates (sugar), &c. . . .	75.7	74.4
	100.0	100.0

The mean results of 27 somewhat more detailed analyses of Aberdeen yellow turnips, comprising about 800 roots, grown with a great variety of manures at Carbeth, Stirlingshire, gave Mr David Wilson, jun., the following figures:[2]—

	In fresh roots.	In dry matter.
Water . .	91.09	...
Sugar . .	4.72	52.94
Fibre . .	1.03	11.54
Albuminoids .	0.54	6.06
Non-albuminoid nitrogen × 6.25 .	0.60	6.76
Extractive matter free of nitrogen .	1.36	15.23
Ash . . .	0.66	7.47
	100.00	100.00

Variation in Composition of Turnips.—The quantity of nutritive matter in the same variety of the turnip varies greatly. In white turnips it may vary from 7 to 11 per cent, and in the yellow turnip from 8 to 13 per cent.

In an interesting paper contributed to the *Transactions of the Highland and Agricultural Society* for 1906 by the Society's chemist, Mr James Hendrick, much useful information is given regarding the variation in the composition of turnips, and also dealing with the increasing of the sugary contents of roots.

Sugar in Roots.—Inasmuch as feeding-roots are essentially *sugar crops*, the sugar they contain is very valuable for meeting the respiratory requirements of sheep and cattle, also for fat-forming and for milk-production. The following table, based on the experiments of Sir John Bennett Lawes and Sir Henry Gilbert at Rothamsted, records estimates of the approximate average percentages of dry matter, and of sugar, in the kinds of roots mentioned:—

	Dry matter.	Sugar per cent.	
		In fresh roots.	In dry matter.
	per cent.	per cent.	per cent.
White turnips .	8.0	3.5 to 4.5	44 to 56
Yellow turnips .	9.0	4.0 to 5.0	44 to 56
Swedish turnips	11.0	6.0 to 7.0	55 to 64
Mangel . . .	12.5	7.5 to 8.5	60 to 68

A bushel of turnips weighs from 42 lb. to 45 lb.

Excess of Water in Roots.—In feeding with roots farmers are sometimes apt to forget or overlook with how much water the feeding matter in the roots is associated. Unless an animal gets some dry food as well as roots, it is forced, in order to obtain sufficient solid nutriment, to consume a very large quantity of water — very much more, in cold weather, than is necessary for it. This water when swallowed has to become warmed at the expense of the heat of the animal, which has simultaneously to be replaced by fresh heat—so that part of the sugar, &c., of the roots, instead of going to fatten the animal, is wasted in furnishing fuel to warm the superfluous water swallowed in the root-substance.

Desirability of Economising Turnips.—Over and over again, in various parts of this work, prominent reference is made to the great and avoidable waste which thus takes place in the old-fashioned and time-honoured system of turnip-and-straw feeding. It is needless here to reason out the point at great length. The above statement as to the deleterious influence of the excess of cold water the animal has to swallow in a full meal of roots will suffice here for that part of the subject. It is also unnecessary to enter into any lengthened arguments to show that other reasons exist which make it

[1] *Trans. High. Agric. Soc.*, xvi. 1884.
[2] Ibid., xviii. 1886.

very desirable that the more economical use of roots in the rearing and feeding of stock should be practised. The root crop is a very costly one to grow, and unfortunately its cultivation is attended with great risks of loss from unfavourable weather, and fungoid and insect attacks. In dealing with the practical work of feeding the different kinds of stock, special attention is given to the question of how turnips may be most effectually and satisfactorily economised.

The avoidance of this waste is the great plea in favour of giving sheep in the turnip-fields a small daily allowance of cake or corn. They will then eat less of the roots, but will turn what they do eat to much better account.

Turnip-tops.—As a rule, it is better to leave turnip-tops on the field, for they possess considerable manurial value, and, except when other food is scarce, will give a better return in that way than used as food. Still, they contain more nutritive matter than some would imagine, and are useful when scattered on a green field for the use of young cattle or sheep. They should, however, be given with caution, for when eaten too freely they are apt to produce scour. The ash of turnip-tops contains a large quantity of phosphate of lime and potash.

Mangel-wurzel.

This is a most valuable root, grown extensively and with great success in England and Ireland. It needs a warm climate, and is grown in Scotland only to a very limited extent. The orange globe and long yellow kinds have been found to contain a larger amount of the respiratory or fat-forming elements than the long red variety, which agrees with the practical results obtained by the use of those varieties in feeding cattle.

Advantages of Storing Mangels.—The tendency in fresh mangels to produce scour when these are given to cattle is well known to all who have used them, and so also is the fact that this property disappears after the roots have been stored for two or three months. Like good wine, mangels improve by keeping, and it is desirable, as a rule, to delay the consumption of them till spring.

In comparison with turnips, it has been considered that 75 lb. of mangel are equivalent in feeding value to 100 lb. of turnips; but the two varieties vary so much in nutritive value that these proportions cannot be relied upon. The leaves of the mangel are also useful, especially for milch cows, but have a scouring tendency.

The solid matter in mangels ranges from 10 to 16 per cent, but about 12 per cent is general.

Medium *v.* Large Roots.—It is to be borne in mind, with reference to both turnips and mangels, that moderate-sized roots are commonly more nutritious than very large ones. The huge over-sized roots often seen at root-shows are commonly watery, and such dry matter as they do contain is intrinsically less valuable than in normal roots.

Sugar-beet.

Sugar-beet has given excellent results in the feeding of dairy-cows, but as food for stock it is cultivated only to a very limited extent.

Considerable attention has been given to the cultivation of sugar-beet for the production of sugar, and the late Dr A. Voelcker published the results of some very elaborate investigations made by him as to the composition of sugar-beets grown under different circumstances.[1]

Nutritive Value of Sugar-beet.—Dr A. Voelcker considered that the farmer "will run very little risk in trying the experiment to grow sugar-beets instead of common mangels; for although he may not get so heavy a crop as he does when he plants common mangels, it has to be borne in mind that 1 ton of sugar-beet is equivalent, in nutritive qualities as cattle-food, to at least 1½ ton of good common mangel."

Beet-root Pulp.

Beet-root pulp is the refuse left in extracting the sugary juice from the beet-root. It is much esteemed on the Continent for its fattening properties. It is, however, deficient in flesh-forming compounds, and requires the addition of some cake or meal to supply this deficiency. Cotton-cake is recommended

[1] *Jour. Royal Agric. Soc. Eng.*, vii., sec. ser.

for this purpose. Milch cows fed on beet-root pulp and a fair allowance of bean-meal or cotton-cake produce abundance of milk of good quality. Pigs also thrive on the pulp if they get some bean-meal or pea-meal mixed with it. Dr A. Voelcker considered beet-root pulp at 12s. a ton a cheap and valuable food.

Carrots.

The carrot does not contain any appreciable quantity of starch, but this deficiency is counterbalanced by its having about 6½ per cent of sugar. Carrots are excellent food for horses, and are greatly relished by them.

Carrot-tops are admirable food for cows giving milk.

Parsnips.

Parsnips contain more starch, but less sugar, than carrots. The starch in parsnips exists only in the external layers of the root, none whatever being found in the heart. There is nearly double the quantity of solid matter in parsnips of that in turnips; so that 1 ton of parsnips ought to go as far, as a fattening material, as 2 tons of white turnips.

Kohl-rabi.

Kohl-rabi is a valuable food, especially for milch cows. It increases the yield of milk, but does not impart to it any particular flavour of a disagreeable kind, such as is produced by turnips. The leaves of kohl-rabi form an excellent description of food for cattle and sheep.

Cabbages.

Cabbages are not cultivated anything like so extensively as they deserve to be. Cabbages are excellent food for sheep and other stock, and few other crops will give as good a return per acre.

Thousand-headed kale of the cabbage variety is most valuable as a green food for sheep or cows in autumn, early winter, or spring. Sprouting broccoli and winter greens are also cultivated for similar purposes.

Potatoes.

The demand which exists for potatoes as human food, generally renders them too expensive to be employed largely in feeding animals, although as food for most kinds of stock they are valuable.

Value of Potatoes for Cattle.—It has been stated that when potatoes can be purchased for £1, 10s. or £2, 10s. per ton, they will pay to be employed in feeding cattle. This, however, will depend upon circumstances which are liable to variation, such as the market price of other foods, and the selling price of beef. Second and small-sized potatoes are as useful for feeding purposes as larger tubers; and as the potato is a bulky and therefore an expensive article to send a long distance to market, those who grow potatoes to some extent in remote districts will be able to turn their crops to better account by converting the small tubers into meat than by selling the entire crop in its natural state. It is necessary to give potatoes to stock with caution, as the excess of starchy matter, unless counteracted by other foods, may injure the health of the animals.

There are many farmers who have an objection to potatoes as food for cattle. The late Mr M'Combie of Tillyfour said: "I would rather throw potatoes to the dunghill than give them to a store bullock, though I would give them to my fattening bullocks." He would never give them to animals intended to be afterwards grazed.[1]

The albuminoids, or flesh-forming matters, in potatoes are deficient, but there is an exceptionally high percentage of the respiratory or fat-forming elements, which constitute the largest part of the dry matter. For cattle, therefore, potatoes should be used in combination with such other foods as cotton-cake, bean-meal, or pea-meal.

Utilising Diseased Potatoes.—When the potato is attacked with disease, it is the albuminoids, or flesh-forming constituents, that are destroyed: these are partially converted into ammonia and other volatile matters, and hence the offensive smell which is emitted from diseased potatoes. The starch, &c., remains intact, and advantage is taken of this by employing diseased potatoes in the manufacture of starch.

[1] *Cattle and Cattle-Breeders*, p. 13.

Diseased potatoes may, for the same reason, be turned to account for feeding animals, particularly swine. In order to do this, it is necessary to thoroughly cook the potatoes either by boiling or steaming—the latter, when practicable, being the better way—and then pack the cooked potatoes into flour-barrels or casks, ramming them well down, and sprinkling some salt occasionally through the mass. When the barrel or cask is filled to the top, it must be closed from the air, and the potatoes will keep for some time fit for use.

Potatoes for Horses.—Potatoes are often fed to horses, but when freely given in a raw condition, they are liable to produce colic.

Water with Potatoes.—Water should not be given to animals fed on either raw or cooked potatoes, for some time after the meal.

Green Rape.

Rape in a green or growing state is usually fed off with sheep, or cut and used as soiling food for house-fed cattle. It is a nutritious and valuable plant for these purposes, and for spring and autumn food it should be grown much more extensively than it is.

Furze, Whins, or Gorse.

Like many other useful and beautiful plants indigenous to this country, furze —in some parts called whins, in others gorse—is not so highly esteemed as it ought to be, perhaps on account of its being so common, and of its tendency to grow where it has not been sown and is not wanted. Nevertheless, as food for cattle, sheep, and horses, it possesses very considerable value, and for this purpose it may be grown in any part of the country with success, financially and otherwise.

Furze as Winter Food.—The chief value of furze is as a green food for the winter months. It should be cut at least once every year, so that the plants may not be allowed to become too woody and hard. When sown thickly on fairly good land the shoots come up fine and juicy, growing to a length of from 2 to 2½ feet. The crop may be cut with the scythe, or with a strong mower past its best for regular harvest work —generally with the scythe.

Preparing Furze as Food.—Before being given to stock the furze should be cut into short pieces by a strong chaff-cutter, or, better still, bruised and cut by a machine which has been specially designed for the purpose, aptly named the "Masticator," and made by Mackenzie & Sons, Cork. This useful machine may be driven by horse, water, or steam power.

Some think it desirable to chop or masticate the furze daily as required; but others perform this work twice a-week, and find that the chop keeps well enough.

How fed to Stock.—An agriculturist, who had thirty years' experience of furze as food for stock, said: "Cut up the furze with hay for milking cows, and you will make first-quality butter, but pale—with hay for horses, but do not feed too heavily; add 3 or 4 lb. mangels to counteract a resin the furze contains. Young stock thrive amazingly upon it. Furze-fed cattle are hard to be fattened on other food; oaten straw, with cut furze for them."

Mr R. O. Pringle stated that horses may be kept through the winter on furze without hay, and only a moderate allowance of oats; and the furze gives the horses a fine coat of hair. An acre of well-grown young furze, which is regularly cut, will keep four or five horses or cows during the winter and early spring months with very little assistance in the shape of hay or roots. For hard-working horses it should be accompanied by a liberal allowance of bruised oats or other concentrated food. Both horses and cattle take to it readily, but sheep do not eat it willingly except when there is snow on the ground. When grown as food for sheep, the crop is not cut, and in a snowstorm a few acres of young juicy furze are most valuable for sheep.

Composition of Furze.—That furze should, in practice, prove to be a useful food, will not surprise any one when it is considered that it contains about 3.20 per cent of albuminoids and about 9.40 of sugar, digestible fibre, &c. Its proportion of water is about 72 per cent, and fibre 13.33 per cent.

Grasses and Clovers.

It may seem strange, but it is nevertheless true, that farmers possess less reliable knowledge as to the relative cropping and feeding value of the various grasses which cover their pastures, than as to that of any of the other leading crops of the farm. A good deal of fresh knowledge as to the habits and characters of our grasses has, no doubt, been gained in recent years, but investigations and experiments must be prosecuted much further before it can be said that we know our pastures and our hay crops as well as we do our crops of roots and grain.

There are special circumstances which render the investigation of this subject very difficult. Root and grain crops are usually matured, or almost so, before they are fed to stock, and thus it has been comparatively easy to obtain reliable information as to the average composition of food-mixtures consisting of these commodities. With grasses, however, especially those which are constantly grazed, the case is different. They are eaten at all stages of their growth, in extreme youth, full bloom, old age, and all the intervening stages. It is well known that the nutritive properties of plants vary at different stages of the development of the plants; and it does not follow that all grasses which show a useful composition when fully grown, are equally useful and suitable for grazing by stock in the earlier periods of their growth. Again, plants which would not stand well in an analysis of hay, may be extremely serviceable as an element in pastures to be regularly grazed.

The determining of the amount of nutrition—the grazing value—possessed by the different plants which compose our pastures, sown and natural, temporary and permanent, is thus at once a matter of the greatest difficulty and the utmost importance. No subject could more worthily engage the attention or employ the resources of the leading agricultural societies; and it is a matter, too, in which a great deal of good might be done by private experiment and investigation by farmers who have opportunities of studying their pastures, and watching the progress of the animals which feed upon them.

Composition of Grasses and Clovers at Different Stages of Growth.—In the 'Eighties of the last century the most extensive investigation ever carried out in this country regarding the nutritive value and produce of British-grown grasses was conducted by Mr (now Dr) David Wilson at Carbeth, Stirlingshire. Much valuable information on the subject is afforded in lengthy reports on these investigations which appear in the *Transactions of the Highland and Agricultural Society* for the years 1886 and 1889. From the later of the reports are taken the tables on page 285, giving (1) the Average Composition of Grasses at Different Stages of Growth, and (2) the Average Composition of Clovers at Different Stages of Growth.

Feeding Value of Clovers.—As to the clovers, which occupy a prominent place in pastures as well as in hay, they are well known to possess high feeding properties.

Alsike clover, which is much esteemed for damp soils, and is specially suited for meadows, shows a rather higher nutritive value than either of the other clovers.

In composition, lucerne and sainfoin closely resemble the clovers.

Composition of Grasses.—Mr Martin John Sutton's valuable work, *Permanent and Temporary Pastures* (the first edition of which was issued in 1886), contains a series of analyses of the principal agricultural grasses, made specially for the purpose by Dr John A. Voelcker. A precise and clear description of each grass accompanies the analysis, and this, with the beautifully coloured illustrations of grasses, and Mr Sutton's practical directions as to the formation and treatment of temporary and permanent pastures, renders the work one of remarkable value.

Dr J. A. Voelcker explains that each variety thus analysed was grown separately and was perfectly pure—the sample being taken, in every instance, as nearly as possible at the time when it would have been cut for hay. And the analysis of each grass is shown in its natural state and dried at 212° Fahr.—that is, until nothing but the solid or dry matter remained.

(1) AVERAGE COMPOSITION OF GRASSES AT DIFFERENT STAGES OF GROWTH.

	Number of Analyses Averaged.	Percentage Water in Green Grass.	Composition of 100 Parts Dry Matter.						Percentage of total Nitrogen Non-Albuminoid.	Percentage of Albuminoids Digestible.	Comparative Value of Dry Matter. Cocksfoot, 1st cut=100.
			Total true Albuminoids.	Non-Albuminoid Nitrogen ×6.25.	Fat, Wax, and Chlorophyll.	Extractive Matter free of Nitrogen.	Ash (including Sand).	Fibre.			
Young undergrowth .	21 complete [1]	74.50	13.66	3.13	4.64	46.23	11.43	20.91	18.6	60.1	137
Longer undergrowth, before shooting	6 complete 11 partial [2]	74.92	9.08	2.80	2.55	47.71	10.31	27.55	23.5	60.1	110
Shot, but before bloom, one or two beginning to show bloom	11 complete 12 partial [3]	76.26	7.93	2.84	3.02	47.65	9.07	29.49	26.3	52.6	102
Coming into bloom and till full bloom	9 complete 6 partial [4]	72.59	8.30	2.56	2.34	47.53	8.47	30.80	23.5	55.8	103
After bloom till seed full-sized	2 complete 5 partial [5]	67.33	5.77	1.24	1.49	52.78	6.85	31.87	17.7	..	88
Seed full-sized till ripe	13 complete 7 partial [6]	65.66	5.29	1.22	2.27	48.51	7.95	34.76	18.7	44.6	83

The analyses of the following cuttings of grasses were averaged to obtain the above mean composition for each stage of growth :—

[1] 3d cut of cocksfoot, foxtail, tall fescue, meadow fescue, sweet vernal, golden oat, timothy, perennial rye-grass, wood meadow, rough-stalked meadow, crested dogstail, hard fescue, fine-leaved sheep's fescue, various-leaved fescue, smooth-stalked meadow, Hungarian forage grass, floating sweet grass, reed canary, wood fescue, and 1st cut of florin and floating sweet grass.

[2] 1st cut of timothy, Hungarian forage, reed canary, and wood fescue. 2d cut of various-leaved fescue, smooth-stalked meadow, Hungarian forage, floating sweet, reed canary, and wood fescue. 3d cut florin. 1st cut floating sweet. 2d cut florin, various-leaved fescue, smooth-stalked meadow, floating sweet, and reed canary.

[3] 1st cut of cocksfoot, tall fescue, meadow fescue, golden oat, P. rye-grass, rough-stalked meadow, crested dogstail, tall oat, and various-leaved fescue. 2d cut of hard fescue and florin. 3d cut of tall oat. 1st cut of wood fescue. 2d cut of cocksfoot, tall fescue, meadow fescue, sweet vernal, timothy, P. rye-grass, rough-stalked meadow, crested dogstail, hard fescue, and Hungarian forage.

[4] 1st cut of foxtail, sweet vernal, wood meadow, hard fescue, fine-leaved fescue, and smooth-stalked meadow. 2d cut of rough-stalked meadow and tall oat. 1st cut of florin, Hungarian forage, and reed canary. 2nd cut of foxtail, golden oat, tall oat, and wood fescue.

[5] 2d cut of cocksfoot, tall fescue, meadow fescue, and golden oat. 1st cut of timothy and various-leaved fescue. 2d cut of wood meadow.

[6] 2d cut of foxtail, sweet vernal, timothy, P. rye-grass, wood meadow, crested dogstail, fine-leaved sheep's fescue. 1st cut of cocksfoot, foxtail, tall fescue, meadow fescue, sweet vernal, golden oat, P. rye-grass, wood meadow, rough-stalked meadow, crested dogstail, hard fescue, tall oat, and smooth-stalked meadow.

(2) AVERAGE COMPOSITION OF CLOVERS AT DIFFERENT STAGES OF GROWTH.

	Number of Analyses Averaged.	Percentage Water in Green Clover.	Composition of 100 Parts Dry Matter.						Percentage of total Nitrogen Non-Albuminoid.	Percentage of Albuminoids Digestible.	Comparative Value of Dry Matter. Cocksfoot, 1st cut=100.
			Total true Albuminoids.	Non-Albuminoid Nitrogen ×6.25.	Fat, Wax, and Chlorophyll.	Extractive Matter free of Nitrogen.	Ash (including Sand).	Fibre.			
Very young leafy growth . . .	1 complete [1]	86.78	23.75	4.02	5.12	40.16	11.07	15.88	14.5	66.5	201
Young growth before bloom . . .	6 complete [2]	80.92	15.70	4.36	3.74	47.60	11.41	17.19	21.7	67.3	156
In bloom . . .	7 complete 6 partial [3]	79.71	13.46	3.87	2.96	47.18	10.93	21.60	22.3	63.2	137
After bloom . .	2 partial [4]	81.51	10.66	..	..		..	29.86	..	..	116

The analyses of the following cuttings of clovers were averaged to obtain the above mean composition for each stage of growth :—

[1] 1st cut of perennial red clover 1885.

[2] 3d cut of perennial red clover 1885; 1st and 3d cuts perennial red (1887), 3d cut Dutch (1887), 1st and 3d cuts alsike (1887).

[3] 1st cut perennial red 1885, 2d cut and 1st and 2d cut perennial red (1887), 1st cut Dutch (1885), 1st and 2d cut and 1st and 2d cut Dutch (1887), 1st cut alsike (1885), 2d cut and 1st and 2d cut alsike (1887).

[4] 2d cut and 2d cut perennial red (1885).

The following analyses of four of the grasses, taken from this volume, will indicate the great value of the work to practical farmers :—

	Cocksfoot.		Meadow Foxtail.		Rye-Grass.		Meadow Fescue.	
	Grass in natural state.	Dried at 212° Fahr.	Grass in natural state.	Dried at 212° Fahr.	Grass in natural state.	Dried at 212° Fahr.	Grass in natural state.	Dried at 212° Fahr.
Water	60.74	...	55.58	...	62.01	...	71.04	...
Soluble albuminoids [1]	.25	.62	.50	1.13	.38	1.00	...	...
Insoluble albuminoids [2]	1.50	3.81	2.56	5.75	2.06	5.38	1.13	3.88
Digestible fibre	11.30	28.78	14.22	32.01	7.98	21.01	8.91	30.77
Woody fibre	16.24	41.36	16.42	36.96	17.71	46.62	12.51	43.19
Soluble mineral matter [3]	2.04	5.19	2.58	5.81	2.90	7.64	1.05	3.62
Insoluble mineral matter [4]	.91	2.32	.94	2.11	.78	2.05	.64	2.21
Chlorophyll, soluble carbohydrates, &c.	7.02	17.92	7.20	16.23	6.18	16.30	4.72	16.33
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
[1] Containing nitrogen	.04	.10	.08	.18	.06	.16	...	...
[2] Containing nitrogen	.24	.61	.41	.92	.33	.86	.18	.62
Albuminoid nitrogen	.28	.71	.49	1.10	.39	1.02	...	...
Non-albuminoid nitrogen	.18	.46	.30	.67	.38	1.00	.18	.62
Total nitrogen	.46	1.17	.79	1.77	.77	2.02	.36	1.24
[3] Containing silica	.35	.89	.37	.83	.05	.13	...	...
[4] Containing silica	.51	1.29	.52	1.17	.32	.84	.39	1.35

Hay.

Loss in Hay-making.—In considering the feeding value of hay it must be borne in mind that the analyses of fresh grasses cannot be relied upon as a key to the nutritive properties and value of hay made from these grasses. If hay were simply *dried* grasses and clovers, then there would be no loss of nutriment and no deterioration in feeding value—water only would have passed away. But in farm practice it is impossible to secure this. In hay-making, even in the best of weather and under the most careful management, there always will be some loss of feeding material.

Damaged Hay.—Here it will suffice to state that in the process of making, hay may be so much spoiled as to be almost worthless as food for stock. In experiments at Rothamsted it was found that sheep would increase in weight on well-made hay alone; but in experiments conducted by Dr A. Voelcker, and lasting three months, it was shown that, fed wholly upon hay which had been damaged by wet weather in making, sheep actually lost in weight. This result proves at once the great importance of exercising skill and care in hay-making, and the imprudence of attempting to maintain stock solely on damaged hay.

It thus becomes apparent that, in giving hay to stock, the physical condition as well as the original quality of the hay must be carefully considered, and the quantities of it and accompanying other foods regulated accordingly.

Feeding Value of Hay.—In average years the price which good hay commands for use as food for horses is usually too high to admit of its extensive employment in the feeding of cattle. If the better qualities of hay are used for cattle at all, they are generally given sparingly. Secondary qualities, especially of meadow-hay, are fed largely to both cattle and sheep.

Straw.

Even yet the value of straw as food for stock is not fully understood and

appreciated by the general body of farmers. In recent years more prominent attention has been given to the subject, and much good will be done if farmers are induced to exercise greater care in the utilisation of straw. A large quantity of straw must no doubt be used as litter for cattle and horses; but in many cases, especially when hay is scarce and dear, it will be found advantageous to substitute, say, peat-moss as litter, and utilise the straw, at least *oat*-straw, which is the most easily digested, for feeding purposes. In any case there should be no waste—no more straw under the cattle than they can effectually convert into manure, and—what is still more unsightly—no loose bundles or handfuls of straw lying about the steading where no straw should be.

Feeding Value of Straw.—The value of straw as a feeding material depends not only on the kind of grain to which it belongs, but also on its condition as regards ripeness when it is harvested, and on the land and climate where it is grown. The straw of grain which is cut just as the grain is ripe, while there still remains a tinge of green in the straw, is much more nutritious than that which has been allowed to become over-ripe. Strong, coarse straw is, of course, not so much relished by cattle as that which is finer in the growth.

The preference which is given to oat-straw as food for stock is fully justified. Fine oat-straw, cut before the crop has become quite ripe, is relished alike by cattle, sheep, and horses, and is given extensively to all, especially in the northern parts where the oat is the prevailing cereal. Indeed in many parts of Scotland good oat-straw (given with a small allowance of roots and perhaps a little cake) forms the main portion of the winter food of young store cattle and dry cows. In pea- and bean-straw it will be seen there are also high feeding properties; while wheat- and barley-straw, although less nutritive, likewise possess considerable value as food for stock.

Straw-chaff.—When straw is used as feeding material, it is given either in its natural state, as it comes from the threshing-machine, or it is cut into very short lengths by a machine constructed for the purpose, in which state it is known as straw-chaff or chaffed straw. The latter method is by far the more economical, as by it the amount of waste may be reduced to a minimum. In order to render straw-chaff more palatable to animals, it is either moistened with treacle mixed with water, or it is employed to absorb a quantity of linseed-meal gruel. The dry chaff is also mixed with the oats given to horses, as such admixture has the effect of causing the horses to masticate their oats more fully than they might otherwise do. Then in pulped mixtures straw-chaff is very extensively employed; and it has been clearly proved by experience that by the economical and careful use of cut straw and concentrated foods a greatly increased stock of cattle and sheep may be kept.

Preparing and Storing Straw-chaff.—There is perhaps no better way of turning straw to good account than by cutting it into chaff and storing it for a few months in large quantities with a slight admixture of chaffed green food, salt, and perhaps ground cake. By this system straw remaining over from the previous winter is cut into chaff in spring or summer and stored in barns till the following winter, when it is consumed; thus enabling the farmer to hold over a quantity of the fresh straw for similar treatment next spring or summer. The system is pursued with great success by many farmers, and particularly when roots are scarce the straw-chaff thus prepared will be found most valuable.

Some now use pulped mangels instead of vetches or rye for mixing with the dry straw-chaff as it is being stored, and get better results therefrom.

Compound Cakes and Meals.

Compound or mixed cakes and meals are, as already mentioned, very largely used. Nearly all manufacturers now make a number of such cakes and meals for various purposes, just as manure manufacturers make up special mixed manures for various crops. Thus we have compounded cakes and meals for fattening animals, for dairy cows, for young stock, for pigs, and so forth.

In the manufacture of such cakes, oil-cakes, like cotton-seed cakes, rape-cake, earthnut-cake, and the minor oilcakes are largely used. These are mixed with various cereal by-products like rice meal, dried dreg, and various wheat and maize by-products, and with sweetening materials like locust bean and treacle. Strongly-flavoured spice seeds, like aniseed, fenugreek, dill seed, &c., are also generally introduced in small quantity to give an appetising odour and flavour.

Such mixed cakes are of various qualities. Unfortunately it is easy to mix inferior materials with such good food substances as those mentioned above, and it is difficult to detect admixtures of such valueless substances as ground oat-husks, sweepings, ground screenings of cereals, and such other substances. Purchasers should always be careful to buy mixed cakes and meals on analysis, and they should in particular look to it that the percentages of albuminoids and oil are high, and that the percentage of fibre is low. They should also see that the analysis does not show the presence of more than a very small proportion of sandy matters.

Condimental Foods.

In modern times remarkable ingenuity and enterprise have been directed to the production of "condimental cattle foods" and appetising spices for all kinds of farm live stock. No attempt will be made to describe the composition and individual characteristics of these condimental foods. It may be well, however, to advise farmers never on any account to purchase any of these foods without receiving therewith a warranty as to its freedom from adulteration, and a guaranteed analysis of its chemical composition, in full accord with the provisions of The Fertilisers and Feeding Stuffs Acts. With this analysis before him, and a reference to what is said in this work as to the elements of nutrition in cattle foods, the farmer will be able to form a tolerably correct idea as to the value of the food. A sample of the food may be analysed for a mere trifle, and if it should fall short of the guaranteed analysis, the vendor is fully responsible for the deficiency.

Vetches.

Of all green forage crops, the vetch is the most extensively grown in the United Kingdom. In almost all kinds of soils it can be grown easily, and at comparatively little expense.

Vetches cut when in full bloom, and before seeding, are much relished by all kinds of stock, and it is desirable that this crop should be grown much more extensively than it is.

How Vetches are Fed to Stock.—Vetches contain an exceptionally high proportion of albuminoids, and they are thus very suitable for giving to stock along with starchy foods, such as rice-meal and Indian corn-meal. For this same reason it is not desirable to give highly nitrogenous foods, such as decorticated cotton-cake and beans, along with vetches, for then the food would be badly balanced—there would be an unprofitable, even a dangerous, excess of albuminoids. Vetches should be sown in successive patches, so as to afford a continuous supply of fresh food. When cut just before becoming fully ripe, vetches make excellent hay or silage. Vetches are also largely consumed on the land by sheep.

Green Maize.

Maize has never been grown to any great extent as a forage crop in this country. It would be a gain to British farmers if it could be successfully acclimatised, for maize is capable of producing an enormous yield of succulent food, which is much relished by cattle, and which is well adapted for feeding in a fresh condition along with other foods, such as chopped hay or straw and decorticated cotton-cake, or for converting into silage for winter feeding.

For use as a forage crop, maize is cut green, and before the cobs have formed. Its chemical composition in this form has been found to vary greatly.

Green maize is not a rich food. Its merit lies in the great quantity of palatable succulent food it produces per acre. It is deficient in nitrogen, but along with highly nitrogenous foods such as decorticated cotton-cake it is most suitable and acceptable to all kinds of stock. It has

been found that 120 lb. of green maize and 2 lb. of decorticated cotton-cake made an excellent food for dairy-cows.

In a dry summer, when grass is scarce, green maize, chopped and mixed with chaffed straw or hay, will be found to be a valuable food for cows or young cattle. A sprinkling of crushed decorticated cotton-cake—1½ or 2 lb. per head—would make this a nutritive mixture for cows giving milk.

Sorghum.

Sorghum saccharatum is a tall-growing plant, similar in appearance to maize, but finer in the stem. In warm climates it grows with great luxuriance, and when cut green, forms excellent forage for stock. It is hoped that hardy varieties of it may be raised, so that it may be successfully cultivated in this country. As yet experiments have been confined to the south and centre of England, and so far the experience has been variable.

Sorghum is exceptionally rich in sugar, and is therefore specially suitable for feeding along with decorticated cotton-cake. Fed alone to cows it has a tendency to cause looseness; but 2 lb. of decorticated cotton-cake to 100 lb. of green sorghum corrects this, and makes an excellent daily ration for cows in milk.

Lucerne.

Lucerne is exceptionally rich in albuminous matters, and is even more nutritious than red clover. It affords a large yield, under favourable circumstances sometimes close on 20 tons per acre; and is most useful when sown in a small patch near the steading, to be cut as required for consumption.

Young lucerne given alone, or as the principal food, has a tendency to cause the animals to become blown; but this danger is avoided by giving it along with straw, the two being chaffed together—an excellent method of turning straw to good account as food.

Sainfoin.

Sainfoin is peculiarly valuable in sheep-farming districts, and seems to sustain little or no permanent injury by being grazed by sheep. Unlike lucerne, it has no tendency to cause blowing in cattle. Sainfoin is less nutritious than lucerne, and does not give nearly so large a yield per acre.

Prickly Comfrey.

There is much difference of opinion as to the value of prickly comfrey as a forage crop. It is a hardy and prolific plant; and in good soil, well manured, will afford a large yield. There is probably no forage-plant that has made warmer friends or more bitter enemies than prickly comfrey. It is a somewhat coarse watery food, not much relished by cattle at the outset, but useful as a green food for dairy-cows.

Dr Augustus Voelcker considered that prickly comfrey "has about the same feeding value as green mustard, or mangels, or turnip-tops, or Italian rye-grass grown on irrigated lands."

Sugar.

In animal economy sugar and starch perform similar functions, and experiments conducted by the late Sir John Bennett Lawes[1] showed that, "whether for the purpose of supporting the functional actions of the body, or of ministering to the formation of increase, . . . starch and sugar have, weight for weight, values almost identical. . . . Starch and sugar, therefore, as foods, appear to be equivalent; or, in other words, a pound of one, properly used, can produce no more increase in our stock than a pound of the other."

Remarking upon the exaggerated value which had been placed upon sugar as a food for stock, Sir John Bennett Lawes stated that it is nevertheless an excellent food; and that the only question is, what price is sugar worth (in comparison with other foods) for feeding purposes?

Sir John considered that it would not be advisable to use sugar with such foods as cereal grains, maize, rice, roots, or even meadow-hay, as all these are somewhat low in nitrogen; and to dilute the nitrogen that exists still more, by the use of sugar, would tend to waste it. On the other hand, foods containing a large amount of nitrogenous substance, such as leguminous seeds—especially lentils, tares, and beans—as well as linseed-cake,

[1] *Jour. Royal. Agric. Soc. Eng.*, vii. 388.

cotton-cake, and clover-hay, might be safely diluted with sugar.

Fish Products as Animal Food.

The frugal farmers of Norway turn fish-offal to use as food for cattle. Their custom has been to boil down the heads of cod-fish into a kind of soup, which they mix with straw or other fodder and give to cattle, and by the means of this cheap and nutritious food many Norwegian farmers have been able to maintain a much larger stock of cattle than would have been otherwise practicable.

From the refuse of herring a cattle-feeding meal of a useful kind is also made in Christiania. Various trials with it were made in this country, but it did not come largely into use.

Fish guano has useful feeding properties, but it has never been used as food to any appreciable extent.

COMPOSITION OF FOODS.

The composition of the common foods used for farm live stock is shown in the following table taken from Warington's unique little volume entitled *Chemistry of the Farm*:[1]—

PERCENTAGE COMPOSITION OF ORDINARY FOODS.

Food.	Water.	Nitrogenous substance.		Fat.	Soluble carbo-hydrates.	Fibre.	Ash.
		Albu-minoids.	Amides, &c.				
Cotton-cake (decorticated)	8.2	43.2	1.8	13.5	20.8	5.5	7.0
" " (undecorticated)	12.5	20.7	1.3	5.5	34.8	20.0	5.2
Linseed-cake	11.7	26.9	1.1	11.4	33.2	9.0	6.7
Rape-cake	10.4	28.1	4.6	9.8	29.1	10.3	7.7
Earthnut-cake	11.5	45.1	1.9	8.3	23.1	5.2	4.9
Beans	14.3	22.6	2.8	1.5	48.5	7.1	3.2
Peas	14.0	20.0	2.5	1.6	53.7	5.4	2.8
Wheat	13.4	10.7	1.3	1.9	69.0	1.9	1.8
Rye	13.4	10.5	1.0	1.7	69.5	1.9	2.0
Oats	13.0	10.6	0.7	5.4	57.3	10.0	3.0
Barley	14.3	10.2	0.4	2.1	66.0	4.5	2.5
Maize	11.0	9.8	0.6	5.1	70.0	2.0	1.5
Malt sprouts	10.0	16.6	7.1	2.2	44.1	12.5	7.5
Wheat bran	13.2	12.1	2.0	3.7	56.0	7.2	5.8
Brewers' grains	76.2	4.9	0.2	1.7	10.7	5.1	1.2
" " (dried)	9.5	19.8	0.8	7.0	42.3	15.9	4.7
Rice meal	10.3	11.3	1.0	12.0	47.8	8.6	9.0
Oat-straw	14.5	3.5	0.5	2.0	37.0	36.8	5.7
Barley-straw	14.2	3.2	0.3	1.5	39.1	36.0	5.7
Wheat-straw	13.6	3.3		1.3	39.4	37.1	5.3
Pea-straw	13.6	9.0		1.6	33.7	35.5	6.6
Bean-straw	18.4	8.1		1.1	31.0	36.0	5.4
Pasture grass	76.7	2.9	1.1	0.9	10.9	5.2	2.3
Clover (bloom beginning)	81.0	2.6	0.8	0.7	8.0	5.2	1.6
Clover-hay (medium)	16.0	10.5	2.5	2.5	37.2	25.0	6.3
Meadow-hay (best)	15.0	10.2	1.8	2.3	39.5	24.0	7.2
" " (medium)	15.0	8.0	1.2	2.2	42.0	25.4	6.2
" " (poor)	14.0	6.3	0.5	2.0	41.1	31.0	5.1
Grass silage (stack)	67.0	3.3	1.5	1.5	13.2	9.7	3.8
Clover silage (stack)	67.0	3.3	2.7	2.2	10.5	11.9	2.4
Maize silage	79.1	1.0	0.7	0.8	11.0	6.0	1.4
Potatoes	75.0	1.2	0.9	0.2	21.0	0.7	1.0
Cabbage	85.7	1.7	0.8	0.7	7.1	2.4	1.6
Carrots	87.0	0.7	0.5	0.2	9.3	1.3	1.0
Mangels (large)	89.0	0.4	0.8	0.1	7.7	1.0	1.0
" (small)	87.0	0.4	0.6	0.1	10.2	0.8	0.9
Swedes	89.3	0.7	0.7	0.2	7.2	1.1	0.8
Turnips	91.5	0.5	0.5	0.2	5.7	0.9	0.7

[1] Vinton & Co., Ltd., London.

ANIMAL NUTRITION.

In order to understand the value of foods to the animal it is not sufficient to know their chemical composition, some account of which is given in the immediately preceding pages. The use of the food to the animal, and the part which its different constituents play in animal nutrition, have also to be taken into account. For the appended notes on these subjects the editor is indebted to Mr James Hendrick, B.Sc., F.I.C., chemist to the Highland and Agricultural Society of Scotland.

Constituents of Foods.

The chief constituents of the dry matter of foods may be divided into four classes: (1) proteins, (2) fats, (3) carbohydrates, and (4) ash constituents. In addition to these, foods contain more or less water, and a number of minor constituents such as amide bodies, organic acids, &c.

The essential substances which all animals require to consume in their diet are: (1) water, (2) proteins, (3) fats and carbohydrates, and (4) ash constituents.

In the analysis of feeding-stuffs it is usual to state (1) the moisture or water, (2) the albuminoids, (3) the oil, (4) the soluble carbohydrates, also often called the non-nitrogenous extract, or the starch, sugar, gum, &c., (5) the fibre, and (6) the ash. In this statement the term albuminoids generally means the protein substances, together with a greater or less percentage of other nitrogenous bodies, such as amide substances. In concentrated foods the so-called albuminoids are composed almost entirely of true protein bodies, but in some of the bulby foods, such as turnips and mangels, a large part of what is commonly called albuminoids consists of the much less valuable amides.

The term oil in a food analysis indicates, or should indicate, fatty oils or fats. The fats in vegetable foods are generally liquid fats, and hence the rather vague term oil is commonly applied to them. In a feeding-stuff the term oil should be synonymous with fat.

The substances classed as soluble carbohydrates, and as fibre in a food analysis, are practically all carbohydrates. Some of the carbohydrates, such as starches and sugars, are easily dissolved, and these form the soluble carbohydrates; while other carbohydrates, like the celluloses, are very difficult to dissolve, and these form the main part of what is called fibre, or sometimes, quite wrongly, "indigestible fibre," or "woody fibre," in a food analysis.

The ash constituents consist of a variety of more or less valuable mineral substances.

The Functions of Food.

The functions of the food of an animal are (1) to build up the body itself, (2) to supply the body with a source of energy, and (3) to form fat in the body.

The bodies of animals are composed of (1) water, (2) nitrogenous matters, (3) fat, and (4) ash or mineral constituents. Water is, except in the case of very fat animals, the constituent which is present in greatest quantity. It usually forms over half the weight of the body and, except in the case of fat animals, over 60 per cent of the weight.

The nitrogenous matters of the body consist mainly of proteins, but various nitrogenous bases are also present in smaller amount. The muscle and nerve fibres, the blood cells, the skin and, generally speaking, the working mechanism of the body, are built up mainly of protein substances.

The fat of the body is essentially a reserve material, which is stored up from excess of food as a reserve supply of energy-producing material, to be drawn upon when the food-supply is deficient. The store of fat is comparatively small in the working animal. When an animal is starved for some time his fat store may be almost or entirely exhausted. On the other hand, highly fed animals which have not any great amount of work to do lay up large

stores of fat, especially in the case of those animals in which the tendency to store up fat has been specially cultivated in order that they may be used for human food.

The ash constituents of the body form a comparatively small proportion of the total weight. They include potash, soda, lime, phosphoric acid, chlorine, sulphuric acid, and other constituents in lesser quantities. They are found in all parts of the body. The bones are specially rich in ash, which consists mainly of lime and phosphoric acid; but the blood, nerves, muscles, skin, &c., also contain mineral constituents.

Carbohydrates are also found in the bodies of animals, but only to a small extent. They are not built up in any large quantity into the tissues, but merely form a small floating reserve of material, which can be immediately drawn upon for the supply of energy.

Proteins and ash constituents must be present in the food in order to supply material for the building of the body. Every animal requires a certain minimum of these two constituents in its food. It has been pointed out above that the essential parts of the body are built up of protein substances and ash constituents, together with water; only protein substances appear to be capable of building up the nitrogenous tissues, and a supply of potash, lime, phosphates, &c., in suitable forms of combination, is essential for building up the bones, and contributing the necessary ash constituents to the other tissues.

A supply of common salt is also essential to the carrying on of certain functions of the body, such as digestion.

Fats and carbohydrates cannot build up the essential parts of the body, but are useful as sources of energy. It is only the smaller portion of the food which is necessary for building up the body and repairing its waste; the greater portion is used as a source of energy. Energy is the power or capacity to do work. The body is constantly engaged in doing work. Even where no external work is done, internal work is constantly being done by the heart, respiratory system, digestive system, &c., and some source of energy is required to enable this work to be done. In the food the body obtains supplies of potential energy, which are capable of being turned to kinetic energy, or energy of motion, when the food undergoes oxidation in the animal. The use of carbohydrates and fats to the animal is to act, so to speak, as fuel which can be consumed in the body to supply power of doing work. Any excess of these materials which is not required for the immediate production of energy may be stored in the body as fat, which is reserve fuel.

The organism is constantly expending energy on internal and external work, and in maintaining the body temperature. It may be said that to supply energy is the function of food. In the last resort most of what has been used in building up the body itself will be consumed as a source of energy. If the organism is not supplied with food it soon exhausts its stores of energy and runs down, and food has constantly to be supplied to maintain the store of energy.

Digestion.

It is only that portion of the food which is digested, that is taken into the blood stream, which is really of use to the animal. Strictly speaking, it is only what is digested that is really food.

The digestive system is a somewhat complicated apparatus for grinding and dissolving the food so as to get it into a fit state for absorption. The food undergoes both mechanical and chemical processes during digestion. It is ground up by the teeth. In ruminants it is soaked, reground, and sifted through the ruminating apparatus before it is fit to proceed to the true stomach, which is commonly called the fourth stomach.

It is acted upon chemically by the saliva, the gastric juice, the pancreatic juice, and the bile. All of these contain substances which assist in breaking up the constituents of the food and rendering them soluble. These dissolving substances are chiefly what are called enzymes or unorganised ferments. Thus the saliva contains an enzyme, ptyalin, which, like the diastase of malted grain, dissolves starch and changes it into sugar.

Much of the material which composes food is in an insoluble state. In the case

of fibrous foods like hay and straw the greater part of the carbohydrates is in forms which are very difficult to break down and dissolve. The digestive system of animals which naturally live on a tough fibrous food is large and elaborate, so as to enable them to deal with such food. This is particularly the case with ruminants, which are able to live upon a much more fibrous food than the pig or even than the horse.

The carbohydrates of the food are changed into sugar before they are resorbed. Whatever is the form in which the carbohydrate is taken into the mouth of the animal, whether as sugar, starch, cellulose, or mucilage, it is taken into the blood as sugar. The protein substances are also broken up into the more soluble and simpler proteoses and peptones before they are resorbed. To a certain extent they are broken up still further into amides during the digestive processes. The fat which is digested is first changed into an emulsion, and to a certain extent saponified, that is, turned into soap, by the bile.

In addition to the processes already mentioned, the food undergoes a certain amount of fermentation due to bacteria. Such action takes place especially in the long and complicated digestive systems of animals which feed on fibrous food. Owing to these fermentative actions much cellulose is broken up and some of it rendered available for digestion. At the same time a large amount of gas is produced, as well as other substances such as butyric and acetic acids. The gas which is produced in the intestines is excreted and is really an addition to the matter excreted in the dung. It contains much methane. This subject will be referred to again later.

The portion of the food which is not digested is excreted in the dung. The dung of herbivorous animals consists almost entirely of the undigested part of the food. The digestibility of food is determined by weighing the food and subtracting from it the weight of what is excreted as dung. This is not quite accurate, (1) as part of the digestive secretions of the animal are contained in the dung, and (2) on account of the gas which is excreted from the intestine, which is not weighed with the dung. In the case of herbivorous animals this gas may cause a very serious error, and therefore special means of measuring it have been devised.

In Warington's table,[1] given on p. 294, the digestibility for ruminants of a number of the most common foods is given. These figures express the percentages of the total organic matter, and of the chief constituents, nitrogenous matters (proteins and amides), fat, soluble carbohydrates, and fibre which are digested. Such figures are sometimes called digestion coefficients. They are obtained by weighing and analysing the food eaten by animals over a period, and weighing and analysing the dung excreted over the same period, and calculating the digestibilities of the total organic matter and its different constituents from the difference between the amount eaten and the amount excreted in the dung.

The figures in the table are averages taken from German experiments. Very little investigation into the nutrition of farm animals and the digestibility of their food has been done in this country. For information on such subjects we are almost entirely dependent on foreign, and especially on German, work. In recent years much work on the nutrition of farm animals has been done in the United States also.

It is to be remembered that some of the digestion coefficients, given in tables derived from foreign investigations, may not apply strictly to foods grown in our climate. For instance, straw grown in the cool moist climate of Scotland may differ materially from straw grown in the drier and warmer continental climate of Germany or the United States.

As the table (p. 294) shows, the fibre of a food is by no means indigestible to ruminants; and, on the other hand, it shows that the soluble carbohydrates, fat, and nitrogenous matters are far from being entirely digestible. Generally speaking, the more fibrous a food the lower is the digestibility. But the lowering of the digestibility is not confined to the fibre, but is exhibited by the soluble carbohydrates, fats, and nitrogenous matters. The more fibrous a food the

[1] *The Chemistry of the Farm.* Vinton & Co., Ltd., London.

lower is the digestibility of the total organic matter, including the proteins, fats, and soluble carbohydrates.

In the natural fibrous foods of ruminants, such as hay and straw, the fibre is, generally speaking, almost as well digested as the other constituents. For instance, in a sample of hay of medium quality, a ruminant digests about 60 per cent of the total organic matter, and also about 60 per cent of the fibre. So in a sample of oat-straw a ruminant digests about 50 per cent of the total organic matter, including quite 50 per cent of the fibre.

Another illustration of the effect of fibre is seen by comparing the digestibilities of decorticated and undecorticated cotton-cakes. Undecorticated cotton-cake is much more fibrous than the decorticated cake, and while 76 per cent

EXPERIMENTS WITH CATTLE, SHEEP, AND GOATS. (Warington.)

Food.	Digested for 100 of each constituent supplied.				
	Total organic matter.	Nitrogenous substance.	Fat.	Soluble carbo-hydrates.	Fibre.
Pasture-grass	74	74	64	77	69
Meadow-hay (best)	67	65	57	68	63
" " (medium)	61	57	53	64	60
" " (poor)	56	50	49	59	56
Clover-hay (best)	61	62	60	70	47
" " (medium)	57	55	51	65	45
Lucerne-hay (bloom beginning)	62	77	39	70	43
" " (full bloom)	56	70	39	63	42
Maize silage	62	48	85	68	56
Oat-straw	48	20	33	44	54
*Barley-straw	53	20	42	54	56
*Wheat-straw	43	11	31	38	52
*Bean-straw	55	49	57	68	43
*Cotton-cake (decorticated)	81	87	95	76	?
* " " (undecorticated)	54	74	90	51	16
*Linseed-cake	80	86	90	80	50
*Peas	90	89	75	93	66 ?
Beans	89	88	82	92	72 ?
Oats	71	78	83	77	26
*Barley	86	70	89	92	?
*Maize	91	76	86	93	58
Rice meal	75	63	85	86	26
Wheat bran	71	78	72	76	30
Malt sprouts	81	78	50	86	85
Brewers' grains	62	70	82	63	39
Potatoes	88	66	?	93	?
*Mangels	88	77	?	96	?
*Turnips	88	62	?	99	?

* These results are derived from a few experiments.

of the soluble carbohydrates of the decorticated cake are digestible, only 51 per cent of the same constituents in the undecorticated cake are digestible.

Generally speaking, concentrated foods like grains and cakes, and succulent foods like roots, are more digestible than coarse fibrous foods like hay and straw. Of the cakes and grains about 80 to 90 per cent is generally digestible. Similarly nearly 90 per cent of the organic matter of roots has been found digestible. On the other hand, in straws generally from 40 to 55 per cent of the total organic matter is digestible, and in hays generally from 55 to 65 per cent is digestible. In succulent green herbage from about 60 to 75 per cent of the total organic matter is generally digestible.

The digestibility of any food will vary according to the kind of animal which

eats it. Thus the horse has not so powerful a digestive apparatus as a ruminant, and therefore the digestibility of foods, and particularly of fibrous foods, is lower for the horse than for the ruminant.

In the case of concentrated foods there is less difference in digestibility. Thus the digestibility of the organic matter of medium meadow-hay for the sheep was found to be 59 per cent, but for the horse only 48 per cent. In the case of oats, however, the sheep digested 71 per cent and the horse 68 per cent, while the digestibility of maize was found to be 89 per cent for both sheep and horse.

The following table, from Warington's work,[1] shows approximately the amount of digestible matter obtained by ruminants from 1000 lb. of material in the case of a number of the best known feeding-stuffs.

DIGESTIBLE MATTER IN 1000 LB. OF VARIOUS FOODS.

	Total organic matter.	Nitrogenous substance.		Fat.	Soluble carbo-hydrates.	Fibre.
		Albu-minoids.	Amides, &c.			
Cotton-cake (decorticated)	691	374	18	128	158	13
" " (undecorticated)	422	150	13	50	177	32
Linseed-cake	655	230	11	103	266	45
Peas	747	175	25	12	499	36
Beans	733	196	28	12	446	51
*Wheat	786	92	13	15	656	10
Oats	600	81	7	45	441	26
Barley	715	70	4	19	607	15
Maize	786	73	6	44	651	12
Rice meal	612	67	10	102	411	22
Wheat bran	585	90	20	27	426	22
Malt sprouts	681	114	71	11	379	106
Brewers' grains	137	34	2	14	67	20
" " (dried)	529	136	8	57	266	62
Pasture grass	156	19	11	6	84	36
Clover (bloom beginning)	123	17	8	5	63	30
Clover-hay (medium)	440	47	25	13	242	113
Meadow-hay (best)	511	60	18	13	269	151
" " (medium)	485	40	12	12	269	152
" " (poor)	460	29	5	10	242	174
Maize silage	124	1	7	7	75	34
Bean-straw	412	40		6	211	155
Oat-straw	381	7	5	7	163	199
Barley-straw	426	4	3	6	211	202
Wheat-straw	351	4		4	150	193
Potatoes	213	5	9	1	195	3
Mangels (large)	89	1	8	½	74	6
" (small)	109	2	6	½	96	5
Swedes	87	2	7	1	71	6
Turnips	68	1	5	1	56	5

* In the absence of experiments, it is assumed that wheat is digested like other foods of the same class.

The actual amounts digested will vary somewhat with the quality of the food, and with the personal peculiarities of the animal. The figures shown in the table are averages calculated from a number of experiments upon sheep and oxen with foods of different qualities, and with different quantities of foods.

The figures in this table are as important as those in tables of composition in indicating the true nutritive value of foods. The nutritive value depends upon digestibility as well as upon composition.

[1] *The Chemistry of The Farm.* Vinton & Co., Ltd., London.

Metabolism.

The blood nourishes all the tissues of the body. It carries to them the digested food from the constituents, of which the tissues are built up. It also carries to them the oxygen of the air taken in through the lungs. This oxygen combines with and oxydises materials in the tissues, producing oxydised waste products, and at the same time setting free kinetic energy, which enables the muscular tissues to do work, or which appears in the form of heat. These changes by which the tissues are built up by materials from the blood, and subsequently undergo oxidation and degradation, are known as changes of metabolism.

The oxydised waste products, which are the resultants of metabolism, are chiefly carbonic acid gas, water, urea, and salts. These are collected by the blood, and excreted through their several channels. The carbonic acid gas is carried by the venous blood to the lungs, and there given off with the expired breath. The waste water is partly removed in the moisture contained in the expired air, partly evaporates from the surface of the skin, and partly escapes in the urine. The nitrogenous waste of the body is chiefly urea, though other substances, such as uric acid and hippuric acid, are also excreted.

Herbivorous animals excrete a considerable proportion of their nitrogenous waste in the form of hippuric acid. The nitrogenous waste is collected from the blood, together with the waste salts, by the kidneys in solution in water, and is excreted in the urine. The amount of nitrogen in the urine therefore measures the nitrogenous waste of the body. The amount of carbonic acid gas expired by the lungs measures the waste of carbonaceous matter in the body.

Fats and carbohydrates consumed in the body are completely oxydised, and yield carbonic acid gas and water just as if they had been burned in oxygen outside the body. On the other hand, nitrogenous substances, whether proteins or amides, are not completely oxydised. They are only partially oxydised, and part of their carbonaceous material is excreted as carbonic acid gas, but their nitrogen is excreted in the incompletely oxydised forms of urea, hippuric acid, uric acid, &c. These are capable of undergoing further oxidation, and they remove from the body a certain amount of potential energy which has not been utilised in doing work or producing heat.

Water Requirements of Animals.

Along with their food animals always require a large proportion of water. Water is required since in digestion the great part of the food is absorbed in solution, since the food is carried by the blood mainly in the form of a solution, since the waste products are collected in solution, and in the urine and perspiration excreted in solution, and since not only do the tissues contain a large percentage of water, but the changes which take place in them demand the presence of much water. Much water is also excreted in the dung of animals, especially in the case of animals like the ox, which consume much fibrous food, and yield a bulby wet excrement.

Generally speaking, animals require 2 to 5 parts of water by weight for 1 part of dry food. Sheep require only about 2 parts of water to 1 of dry food; horses, 2 to 3 parts to 1; and cattle, 3 to 4 parts to 1. The proportion of water required is increased by a very fibrous diet, or by a diet rich in protein matters. It is also increased by hot weather, which increases evaporation from the body.

Excess of water is wasteful. Unless the water is given warm, heat is consumed in raising it to body temperature and, as the excess is excreted at body temperature, this heat is wasted. This means waste of food used up as fuel to heat the water. Increased consumption of water also leads to increased waste of nitrogenous matter in the body. The excess of water cannot be passed through the body and excreted without causing increased oxidation of protein matter, the nitrogenous waste of which is excreted by the urine.

In the case of sheep fed upon turnips alone the excess of water consumed is very great, and in consequence quite a large proportion of the dry matter consumed is wasted in heating this excess of water and pumping it through the

system. It therefore tends to economy of food to give sheep dry food along with turnips.

Energy Value of Foods.

It has been shown above that foods are mainly valuable to the animal as sources of energy. One method of comparing the values of foods, therefore, is to compare their energy values—that is, their values as means of producing heat and work. To do this we measure the fuel value of the food or the amount of heat which it produces when burnt in oxygen. Later, the amount of this fuel value which is recoverable in the animal will be considered.

The heat value of fuels is measured by the calorimeter. In this instrument a given weight of the substance under experiment is burnt in oxygen and the amount of heat produced accurately measured by suitable means. The fuel values of coals, oils, and other combustibles are constantly measured in this way for industrial purposes, and similarly the fuel values of all ordinary foods and food constituents have been measured. It is especially to German and American investigators that we are indebted for our knowledge of food calorimetry.

The unit of heat employed is called the "calorie," and it represents the amount of heat required to raise 1 gram of water 1° Centigrade in temperature. For ordinary purposes the "Great Calorie" or "Calorie," which is a thousand times as great as the "calorie," is employed. It represent the heat necessary to raise 1 kilogram of water 1° C.

The fuel value of 1 gram of fat is about 9.4 calories, of 1 gram of protein about 5¾ calories, of 1 gram of carbohydrate about 4 calories, and of 1 gram of urea about 2½ calories. It will thus be seen that the fuel value of fat is much greater than that of proteins, more than twice as great as that of carbohydrates, and nearly four times as great as that of urea.

Since fats and carbohydrates are useful to the animal only for fuel purposes their comparative values entirely depend on their fuel values. In the case of proteins it is otherwise. The fuel value which is recovered in the calorimeter is not entirely recovered in the animal, for the nitrogenous matter is excreted as urea, which has a fuel value of 2½ calories. The fuel value of the urea excreted has therefore to be deducted from the fuel value of the protein. As a matter of fact, a greater fuel value than is represented by the equivalent of urea has to be deducted, for a portion of the nitrogen is excreted in forms such as hippuric acid which have a greater fuel value than urea.

On the other hand, the proteins have a special value to the animal which fats and carbohydrates have not, for they are essential for the formation of the nitrogenous tissues. They have also a special value to the farmer apart altogether from their use in the nutrition of the animal, for their nitrogenous waste which is excreted in the urine has a high manure value. On the other hand, nothing of manure value is derived from fats or carbohydrates. The actual value of nitrogenous substances, therefore, does not by any means depend entirely on the fuel value.

Energy Value of Foods to the Animal.

As has been shown, only digested food is of any value to the animal. The energy value of this has been measured in a large number of cases with much accuracy by Continental investigators. For this work the respiration calorimeter is needed. It is only in the German and American experiment stations that respiration calorimeters are to be found.

It has been shown that the law of conservation of energy holds true for the animal as for less complicated machines. Fats, carbohydrates, and proteins produce the same amount of energy in the animal as they do when oxydised to the same extent outside the animal. So that if we deduct from the digestible food the energy value of the incompletely oxydised nitrogenous substances excreted in the urine, and the energy value of the methane and other gases excreted from the intestine, we obtain its true energy value to the animal.

The table on p. 298[1] shows the heat values found by actual experiment for the digestible organic matter of a num-

[1] *The Chemistry of the Farm.* Vinton & Co., Ltd., London.

ber of foods by Professor Kellner in the case of the ox.

It will be seen from the table that though straw has as great a total calorific value as hay, owing to the greater loss of gas from the intestine during its digestion, the actual calorific value recovered by the animal is less for wheat straw than for hay.

Energy Consumed in Digestion.

The total energy value of the digested food which can be recovered in the animal is not available for productive purposes. In order to digest the food a certain amount of energy has to be consumed, and it is only the balance which is left over after this is supplied that is available for other purposes. The energy consumed in digestion may be very great. It depends mainly on the mechanical condition of, and on the amount of fibre in, the food. The harder, coarser, and more intractable a food is, the more energy must be expended on chewing it and reducing it mechanically to a fine state of division.

In the case of coarse fibrous food such as wheat-straw, the amount of energy spent on its digestion is so great that little is left over for any other purpose. In the case of a horse, which extracts

Food.	Fuel Value of 1 gram Digested Organic Substance.	Losses of Combustible Matter.			Actual Heat Value to the Ox.
		In the Urine.	As Methane.	Total.	
	Cals.	Per cent.	Per cent.	Per cent.	Cals.
Earthnut oil . .	8.8	...	...	...	8.8
Wheat gluten . .	5.8	18.7	...	18.7	4.7
Starch . . .	4.1	...	10.1	10.1	3.7
Meadow-hay . .	4.5	8.5	10.3	18.8	3.6
Oat-straw . . .	4.5	4.7	12.2	16.9	3.7
Wheat-straw . .	4.5	5.6	20.0	25.6	3.3

less from such a food than a ruminant, and does it with greater difficulty, it has been shown by experiment that the amount of nutriment extracted from the straw may not be sufficient to supply energy for the digestion of the food. The results of experiments show that in no case can a horse extract sufficient nutriment from wheat-straw to supply energy to carry on the internal work of the body, and therefore a horse if fed on wheat-straw will starve even if it has no external work to do. On the other hand, an ox can live on wheat-straw and have a balance of energy over after performing the work of digestion and the internal work of the body.

Generally speaking, only a small proportion of the available energy of the digestible matter of such concentrated foods as cakes and grains is required to do the work of digestion itself: the proportion required is larger in foods such as hay, and still larger in straw.

Other Internal Work.

In addition to the energy consumed in the digestion of the food itself, there is a continual consumption of energy for such necessary internal work as that of the heart and of the respiratory system. The circulation and respiration and other functions of the body go on continuously whether the animal is doing any useful work or not. Even when an animal is apparently at rest it is constantly at work internally. A certain amount of food has constantly to be consumed to supply energy for this internal work. This non-productive work has constantly to be done before the animal can utilise any of its food for a productive purpose, such as the performance of external work, or the production

of increase of flesh and fat, or the production of milk.

All the internal work, whether mechanical or chemical, appears ultimately as heat, and therefore helps to maintain the body temperature. The bodies of farm animals have to be maintained at a temperature considerably above that which is normal to their surroundings. So long as the heat produced in internal work is not in excess of that necessary to maintain the body temperature it is not wasted. If sufficient heat is not developed by internal work to maintain the body temperature at its normal, food has to be oxydised in the system merely to maintain that temperature. On the other hand, if the heat produced in the body by internal work is in excess of that required to maintain the normal temperature of the body, the excess is merely run to waste.

It will thus be seen that the energy used for digestion and other internal work, though it is useless for any productive purpose, is not valueless for maintenance purposes, as it serves to maintain the body heat, and if the body heat were not maintained in this way, food-materials would have to be oxydised in the body to maintain it.

Values of Foods for Maintenance and for Production.

Foods may have very different relative values for maintenance and for productive purposes. Thus Kellner showed that in the case of a fattening ox the heat value of the increase of flesh and fat obtained in the animal was about 42 per cent of the total available heat value of the digested food in the case of meadow-hay, but only about 38 per cent in the case of oat-straw, and only about 18 per cent in the case of wheat-straw. The remainder was consumed in non-productive internal work, physical and chemical.

The table[1] (p. 300) shows approximately the comparative values of ordinary foods for ruminants.

All the foods are calculated to their equivalents as starch, on the assumption that the energy value to the animal protein is 1.25 times that of starch, of amides 0.6 times that of starch, of fat 2.3 times that of starch, and of fibre and other carbohydrates the same as starch. Of course only digestible constituents are taken into account, and it has been shown by experiment that these comparative values approximately represent their real energy values to the animal.

The values of all the foods are calculated both for maintenance and for production. The valuation of foods for maintenance does not involve special difficulties, but the valuation for productive purposes is more uncertain, as the basis of accurate experiment on which the calculations are founded is as yet very incomplete.

It is to be remembered that the value of starch itself is not the same for production as for maintenance. Kellner found that for the fattening ox digestible starch had a value of 3.7 calories per gram for maintenance, but only of 2.2 calories per gram for production.

The table (p. 300) shows that while concentrated foods and succulent foods have, in terms of starch, nearly as great values for production as for maintenance, fibrous foods, and especially straw, have very much lower values for production than for maintenance.

The calculation of the comparative values of foods by the methods here adopted is very much more accurate and valuable than the crude method often adopted in this country of calculating what are called "food units." In calculating these food units digestibility is, as a rule, left out of account, and the fibre is treated as if it had no food value at all. The number of food units is commonly calculated by multiplying the sum of the albuminoids and oil by 2½ and adding the soluble carbohydrates. Such a calculation is of little real value.

The comparative food values given in the table apply only to ruminants. Many of the foods, and especially the fibrous foods, have very different values if calculated for horses.

Albuminoid Ratios.

As the protein constituents of a food have a peculiar value as building constituents for the body of the animal, and as a certain amount of protein matter is

[1] *The Chemistry of the Farm.* Vinton & Co., Ltd., London.

necessary in the diet of every animal, the ratio of protein to non-protein material in a food is of some importance. To obtain such a ratio it is necessary to reduce all the non-protein organic matters to a common value. They are, therefore, generally reduced to their equivalent in starch. The ratio then obtained between the protein and non-protein nutrients is called the nutritive ratio or the albuminoid ratio.

The old rough method of calculating the albuminoid ratio was to multiply the total fat or oil by 2½ and add this to the total soluble carbohydrates, and then get the ratio between the total nitrogenous or albuminoid matter and the sum so obtained from the fat and soluble carbohydrates. This method is still often used in this country. It is very inaccurate, and the ratio so obtained is of little or no value. It is only digestible

Comparative Values of Ordinary Foods for Oxen and Sheep.

	For Maintenance.		For Production.	
	Value of 1000 lb. expressed as starch.	Quantities equivalent to 1 lb. of starch.	Value of 1000 lb. expressed as starch.	Quantities equivalent to 1 lb. of starch.
	lb.	lb.	lb.	lb.
Cotton-cake (decorticated)	944	1.06	826	1.21
Maize	859	1.16	825	1.21
Wheat	823	1.21	783	1.28
Linseed-cake	842	1.18	733	1.36
Barley	755	1.32	721	1.39
Rice meal	758	1.32	713	1.40
Peas	796	1.25	702	1.42
Beans	786	1.27	670	1.49
Oats	676	1.48	626	1.60
Wheat bran	635	1.57	578	1.73
Brewers' grains (dried)	634	1.58	533	1.88
Malt sprouts	695	1.44	518	1.93
Cotton-cake (undecorticated)	519	1.93	442	2.26
Meadow-hay (best)	536	1.87	359	2.79
" " (medium)	506	1.98	337	2.97
Clover-hay (medium)	459	2.18	319	3.13
Meadow-hay (poor)	479	2.09	294	3.40
Bean-straw	421	2.38	252	3.97
Oat- and barley-straw	412	2.43	207	4.83
Potatoes	212	4.72	202	4.95
Mangels (small)	108	9.26	99	10.10
Wheat-straw	357	2.80	96*	10.41*
Maize silage	131	7.63	92	10.87
Clover (bloom beginning)	131	7.63	92	10.87
Mangels (large)	87	11.49	76	13.16
Swedes	86	11.63	75	13.33
Turnips	68	14.71	59	16.95

* Thess figures are the production values actually obtained in Kellner's experimenta.

nutrients which are of value to the animal as food. Only digestible nutrients, therefore, should be considered. Further, since digestible fibre has a real food value to the animal, especially for maintenance purposes, it should be included in calculating nutritive ratios.

In the table given on p. 301 [1] the nutritive or albuminoid ratios are calculated from digestible constituents for ruminating animals, and the digestible fibre is taken into account. The non-nitrogenous matters are calculated into their equivalent in starch by multiplying the fat by 2.3 and adding this to the sum of the digestible carbohydrates and fibre. The first column of figures gives the ratio of the total digestible nitrogenous matters to this sum of non-nitrogenous matters.

It has been clearly shown in numerous

[1] *The Chemistry of the Farm.* Vinton & Co., Ltd., London.

investigations that the amide substances which occur in food have not the same value to the animal as true albuminoid or protein substances. Though the amides may to a certain extent save protein in the organism, it cannot take its place. Therefore, to calculate a true nutritive ratio between the real flesh-building substances or proteins, and the constituents which are only of use to the animal for fuel purposes, the amides should be reduced to their equivalent in starch and added on to the non-nitrogenous matters. This has been done in the second column of figures in the table below by multiplying the amides by 0.6 and adding the result to the sum of the fat, carbohydrates, and fibre reduced to their starch equivalent. This column gives the nutritive or albuminoid ratio in its best and most accurate form.

	Total Nitrogenous Substance to Non-Nitrogenous.	Albuminoids to Non-Albuminoids.
Cotton-cake (decor.)	1 : 1.2	1 : 1.3
„ (undecor.)	1 : 2.0	1 : 2.2
Linseed-cake	1 : 2.3	1 : 2.4
Beans	1 : 2.3	1 : 2.8
Peas	1 : 2.8	1 : 3.3
Brewers' grains	1 : 3.3	1 : 3.5
Malt sprouts	1 : 2.8	1 : 4.9
Wheat bran	1 : 4.6	1 : 5.8
Red clover (bloom beginning)	1 : 4.2	1 : 6.4
Oats	1 : 6.5	1 : 7.1
Pasture grass	1 : 4.5	1 : 7.4
Meadow-hay (best)	1 : 5.8	1 : 7.7
Wheat	1 : 6.7	1 : 7.7
Clover-hay (medium)	1 : 5.3	1 : 8.5
Barley	1 : 9.0	1 : 9.5
Bean-straw	1 : 9.5	—
Rice-meal	1 : 8.7	1 : 10.1
Maize	1 : 9.7	1 : 10.5
Meadow-hay (medium)	1 : 8.6	1 : 11.4
„ (poor)	1 : 13.2	1 : 15.2
Potatoes	1 : 14.3	1 : 41.1
Swedes	1 : 8.8	1 : 41.8
Mangels (small)	1 : 12.8	1 : 52.9
Oat-straw	1 : 31.5	1 : 54.4
Turnips	1 : 10.6	1 : 66.3
Mangels (large)	1 : 9.0	1 : 86.0
Barley-straw	1 : 61.0	1 : 107.2
Maize silage	1 : 15.6	1 : 129.3
Wheat-straw	1 : 88.1	—

A far greater value was formerly assigned to the albuminoid ratios of foods than is warranted by the results of experience and of experiment. Precise albuminoid ratios were laid down for working animals, for fattening animals, for milking animals, and so on, and it was supposed that close adherence to these ratios was necessary in order to secure the best results. The modern view is that albuminoid ratios can be treated with much more freedom than was formerly supposed. While they have a certain value in indicating, within certain limits, whether a diet is likely to be suitable to the animals we are feeding and for producing the results we wish to obtain from them, the ratios may have in most cases a considerable amount of elasticity, and may be varied through fairly wide limits without necessarily interfering with the results which are desired.

Thus, in the case of fattening cattle, it was at one time supposed to be necessary to provide a ratio of 1 : 5 or 1 : 6, but it has been shown that cattle may be rapidly fattened with a much wider ratio —say 1 : 16, provided a sufficient excess of digestible food be supplied to build up fat in the body of the animal.

On the other hand, it is still recognised that young animals which are rapidly building up their nitrogenous tissues, and milking cows which are yielding a large quantity of the highly nitrogenous secretion, milk, must have a diet with a comparatively narrow albuminoid ratio, as well as a liberal diet, if the best results are to be obtained.

It is to be remembered that the true albuminoid or nutritive ratio of a food is not the same for different animals with different powers of digestion. Thus meadow-hay of medium quality may have an albuminoid ratio of 1 : 9 for an ox and of 1 : 12 for a horse. This is because the ox is able to digest more of the fibre and carbohydrates of the food than the horse.

FOOD REQUIREMENTS OF ANIMALS.

The food constituents required by animals vary according to the age of the animal and to the use which the animal is to make of its food.

The Young Animal.

The young animal requires a diet rich in those constituents which build up the nitrogenous tissues and bone. It follows that it requires a diet containing a considerable proportion of protein, and therefore of narrow albuminoid ratio. It also requires a sufficiency of suitable mineral constituents, like phosphate and lime, in its diet. Such a diet is provided by nature in the milk of the mother. Cow's milk has a nutritive ratio of about 1 : 3.7.

As the animal becomes older and more active it requires more food for merely fuel purposes, and the nutritive ratio may therefore be gradually widened. But a young growing animal should always receive a considerable proportion of protein substance in its food, as well as a liberal and digestible diet, if the best results are to be obtained.

The young animal requires more food per 1000 lb. live-weight than it does at a later stage. As the animal increases in size the amount of food consumed increases, but the amount of food consumed per 1000 lb. live-weight diminishes.

The Adult Animal.

The adult animal which is merely being maintained, and which is neither working nor increasing in weight, requires food to do internal work, to maintain the body temperature, and to make good the waste of the body and form hair, horn, hoof, &c. For these purposes a poor diet, containing comparatively little nitrogenous matter, is sufficient. The nitrogenous matter is required only to form hair, hoof, &c., and to repair the small amount of waste of nitrogenous tissue in the body. Carbohydrates and fat can be used for all fuel purposes, to maintain the body heat and to supply energy for internal work. A wide albuminoid ratio is therefore sufficient.

It has been shown, for instance, that oxen can be maintained with a diet having a ratio as wide as 1 : 15. Experiment has shown that to maintain an ox of 1000 lb. live-weight about 6.5 lb. of digestible organic matter, reckoned as starch, is the minimum required. This should contain about 0.6 lb. of digestible protein. These requirements would be met by a diet of about 13 lb. of meadow-hay of medium quality.

The Working Animal.

If external work has to be done the quantity of food required increases rapidly with the amount of work. A working animal therefore requires much more food than a mere maintenance diet.

Work is not done at the expense of the nitrogenous tissues of muscle as was at one time supposed, but at the expense of fuel materials consumed in the muscle. Such fuel may be supplied by any of the organic constituents of food, whether proteins, fats, or carbohydrates, and therefore a highly nitrogenous diet is not required in order that work may be done. What is required is sufficient digestible food in excess of that required for mere maintenance, to supply fuel materials for consumption in the working tissues. If that be not supplied the work will be carried on at the expense of the tissues themselves, and the animal will rapidly lose in weight and condition.

While it is not essential to supply food of narrow albuminoid ratio for a labour diet, it is generally advisable to supply working animals with a considerable amount of digestible protein. It is found that a diet fairly rich in protein causes the animal to be more active and to work with more spirit. Large horse users generally provide working horses with a diet having an albuminoid ratio of about 1 : 7.

The Fattening Animal.

Fat may be formed from any excess of organic nutrients over what is required to repair the body and to produce heat and work. Fat is not necessarily formed from the fat or oil in the food. The fat stored up in the body is not the same as the fat given in the food. Thus, if an animal is fed with linseed-cake it does not store up linseed-oil in its fatty tissues.

In the case of our farm animals fat may be formed from carbohydrates or from proteins, and probably any excess of food may go to form fat. The diet of fattening animals does not therefore need to be a highly nitrogenous one.

At one time it was usual in laying down standard rations for fattening animals to insist on narrow albuminoid ratios. These are by no means necessary. Indeed, a fattening diet for an adult animal may have a wider albuminoid ratio than a maintenance diet.

So long as there is excess of digestible food the animal will fatten. It has been shown in Continental experiments that adult animals may fatten rapidly on a diet having an albuminoid ratio wider than 1 : 20 provided plenty of digestible food is given. Similarly in feeding experiments carried on in this country animals have been equally well fattened on diets having very narrow and very wide albuminoid ratios.

At the same time, it is generally convenient and economical in farm practice to feed fattening animals on a diet of moderate albuminoid ratio. There are various reasons for this. Most of the nitrogen of the food of all animals is excreted and returned to the farmer in the urine and dung of the animals. If foods rich in nitrogen, and therefore of narrow albuminoid ratio, are used, the farmyard manure is made richer and more valuable, and the farmer recovers a considerable part of the value of his foods in the manure. Further, a diet containing a moderate amount of proteins and of oil is better digested and utilised by the animal than one consisting mainly of carbohydrates, and for this reason also a certain amount of protein and oil in the food of fattening animals is generally economical. Still, there is no necessity to have the albuminoid ratio of the food of adult fattening animals narrower than about 1 : 10.

The Milking Cow.

Milk is a fluid rich in nitrogenous matter, and if the excess of nitrogenous matters necessary to produce it be not supplied in the food, the animal will take them from her own nitrogenous tissues and will rapidly lose in condition. A cow giving the quantity of milk which is expected from a good dairy animal is returning far more organic matter in the milk than a fattening animal produces in his increase of weight. Thus a cow giving 3 gallons of milk per day gives about 26 lb. of dry matter per week, of which about 7.6 lb. consists of proteins. On the other hand, a fattening ox increasing 2 lb. per day produces about 10.6 lb. of dry matter per week, of which only about 1.1 lb. is protein.

The milking cow therefore requires a plentiful and digestible diet of narrow albuminoid ratio. If properly fed, the milking cow gives a much bigger return for the food consumed than a fattening animal. A milking cow giving a large yield of milk, say 3 gallons per day, does not require more digestible food per 1000 lb. live-weight than a fattening ox. But it is advisable to supply her with food of narrower albuminoid ratio. It is also advisable to feed her largely on such foods as are easily digested, and which do not require a great consumption of energy in their digestion.

The amount of food given to a milking cow should be proportional to the quantity of milk yielded. The albuminoid ratio may safely vary from about 1 : 6 to 1 : 8, provided plenty of food be given.

THE MANURIAL VALUE OF FOODS.

The value of animal excreta as a manure has been recognised perhaps as long as we have any records of agriculture.

It is learned from chemistry that—apart from mere mechanical effects on the texture of the soil—this value is due to the presence of nitrogenous and mineral compounds, of which latter the most important are the compounds of potash and of phosphoric acid. Seeing that, directly or indirectly, all the constituents of animal excreta are derived from the food consumed, it is at once reasonable to suppose that the composition of the food must influence that of the excreta derived from it—that food, rich in nitro-

gen and in phosphates, for example, should produce manure rich in these materials; and that food comparatively poor in these respects should produce manure comparatively poor in them.

Urine.—The urine is the richest part of animal manure, for it is the means whereby is eliminated from the animal system the waste nitrogenous materials which have undergone digestion and served their purpose physiologically. It is rich also in soluble salts of potash and phosphoric acid.

Solid Excreta.—The solid excreta consist only of those materials which have passed through the animal undigested; and if an animal could be fed on theoretically perfect principles, they would possess hardly any manurial value. But practically, an animal always consumes more nitrogenous and phosphatic food than it really digests, and the excess thus consumed gives value to the solid excreta, although this value is generally small compared with that of the urine if the animal is properly fed.

Proportion of Food assimilated and voided.—An animal in order to gain a given increase in live-weight has to consume an enormously greater quantity of food than would be required to produce that increase alone, for the mere sustenance of life involves a large daily consumption of food-material. What becomes of the carbon, hydrogen, and oxygen that is consumed by the animal beyond what it stores up as increase, does not here concern us; but it is essential that we should know what is the destination of the nitrogen and of the mineral matters in the food consumed.

Much attention has been devoted to this point at Rothamsted, and careful inquiry has shown that, of every 10 lb. of nitrogen consumed by an animal in its food, not more than about 1 lb. will be stored up as increase of live-weight, except by a very young animal, the remaining 9 lb. or so being voided in the manure, partly as undigested matter, partly as soluble nitrogenous compounds, which readily become converted, first into ammonia, and then into nitrates, when applied to the soil. Similarly, only from about one-fifth to about one-tenth of the phosphates in food are stored up by the animal, and a still smaller proportion of potash salts, the great bulk of both going to enrich the manure.

The actual proportion of any of these fertilising ingredients retained in any given case will depend upon how liberally the animal is fed, and also upon whether it is a growing animal, having to build up its bony frame and muscles, or whether it is an already adult animal adding little but fat to its carcase-weight; or whether again it may be a cow having to produce its calf, and yield a flow of milk, which will make a heavier demand on the food than will the mere fat-forming processes going on in the case of a stall-fed ox.

Lawes and Gilbert's Manurial Tables.—Taking one case with another, however, it is possible to arrive at an average which shall in no case err very widely; and the careful experiments and calculations made at Rothamsted have furnished us with the following classical tables, indicative both of the original proportions of the chief fertilising ingredients contained in the various foods, and the proportions of these which will, on the average, be voided by animals consuming, say, a ton of any of them.

These tables were first published by Sir John Bennett Lawes and Sir Henry Gilbert in the *Journal of the Royal Agricultural Society of England* in 1885, and were subsequently revised by them and brought up to date in 1897 and 1898.

[TABLES.

LAWES AND GILBERT'S TABLES (1897) OF COMPOSITION AND MANURIAL VALUE OF FOODS.

TABLE I.—AVERAGE COMPOSITION, PER CENT AND PER TON, OF CATTLE FOODS.

No.	Foods.	Per Cent.					Per Ton.		
		Dry Matter.	Nitrogen.	Mineral Matter (Ash).	Phosphoric Acid.	Potash.	Nitrogen.	Phosphoric Acid.	Potash.
		per cent.	per cent.	per cent.	per cent.	per cent.	lb.	lb.	lb.
1	Linseed	90.00	3.60	4.00	1.54	1.37	80.64	34.50	30.69
2	Linseed-cake	88.50	4.75	6.50	2.00	1.40	106.40	44.80	31.36
3	Decorticated cotton-cake	90.00	6.60	7.00	3.10	2.00	147.84	69.44	44.80
4	Palm-nut-cake	91.00	2.50	3.60	1.20	0.50	56.00	26.88	11.20
5	Undecorticated cotton-cake	87.00	3.75	6.00	2.00	2.00	84.00	44.80	44.80
6	Cocoa-nut-cake	90.00	3.40	6.00	1.40	2.00	76.16	31.36	44.80
7	Rape-cake	89.00	4.90	7.50	2.50	1.50	109.76	56.00	33.60
8	Peas	85.00	3.60	2.50	0.85	0.96	80.64	19.04	21.50
9	Beans	85.00	4.00	3.00	1.10	1.30	89.60	24.64	29.12
10	Lentils	88.00	4.20	4.00	0.75	0.70	94.08	16.80	15.68
11	Tares (seed)	84.00	4.20	2.50	0.80	0.80	94.08	17.92	17.92
12	Indian corn	88.00	1.70	1.40	0.60	0.37	38.08	13.44	8.29
13	Wheat	85.00	1.80	1.70	0.85	0.53	40.32	19.04	11.87
14	Malt	94.00	1.70	2.50	0.80	0.50	38.08	17.92	11.20
15	Barley	84.00	1.65	2.20	0.75	0.55	36.96	16.80	12.32
16	Oats	86.00	2.00	2.80	0.60	0.50	44.80	13.44	11.20
17	Rice-meal [1]	90.00	1.90	7.50	(0.60)	(0.37)	42.56	(13.44)	(8.29)
18	Locust-beans [1]	85.00	1.20	2.50	...	...	26.88	...	...
19	Malt culms	90.00	3.90	8.00	2.00	2.00	87.36	44.80	44.80
20	Fine pollard	86.00	2.45	5.50	2.90	1.46	54.88	64.96	32.70
21	Coarse pollard	86.00	2.50	6.40	3.50	1.50	56.00	78.40	33.60
22	Bran	86.00	2.50	6.50	3.60	1.45	56.00	80.64	32.48
23	Clover-hay	83.00	2.40	7.00	0.57	1.50	53.76	12.77	33.60
24	Meadow-hay	84.00	1.50	6.50	0.40	1.60	33.60	8.96	35.84
25	Pea-straw	82.50	1.00	5.50	0.35	1.00	22.40	7.84	22.40
26	Oat-straw	83.00	0.50	5.50	0.24	1.00	11.20	5.38	22.40
27	Wheat-straw	84.00	0.45	5.00	0.24	0.80	10.08	5.38	17.92
28	Barley-straw	85.00	0.40	4.50	0.18	1.00	8.96	4.03	22.40
29	Bean-straw	82.50	0.90	5.00	0.30	1.00	20.16	6.72	22.40
30	Potatoes	25.00	0.25	1.00	0.15	0.55	5.60	3.36	12.32
31	Carrots	14.00	0.20	0.90	0.09	0.28	4.48	2.02	6.27
32	Parsnips	16.00	0.22	1.00	0.19	0.36	4.93	4.26	8.06
33	Mangel-wurzels	12.50	0.22	1.00	0.07	0.40	4.93	1.57	8.96
34	Swedish turnips	11.00	0.25	0.60	0.06	0.22	5.60	1.34	4.93
35	Yellow turnips [1]	9.00	0.20	0.65	(0.06)	(0.22)	4.48	(1.34)	(4.93)
36	White turnips	8.00	0.18	0.68	0.05	0.30	4.03	1.12	6.72

[1] In the case of neither rice-meal, locust-beans, nor yellow turnips, have records of ash analyses been found. For rice-meal the same percentages of phosphoric acid and potash as in Indian corn, and for yellow turnips the same as in swedes, are provisionally adopted; but in all the Tables the assumed results are given in parentheses. For locust-beans no figure has been assumed, and the columns are left blank.

TABLE II.—(1897) SHOWING THE DATA, THE METHOD, AND THE RE- OF CATTLE FOODS

No.	Description of Food.	Fattening Increase in Live-weight (Oxen or Sheep).		Nitrogen.						
				In Food.		In Fattening Increase (at 1.27 per cent).		In Manure.		
		Food to 1 Increase.	Increase per ton of food.	Per cent.	Per ton.	From 1 ton of Food.	Per cent of total consumed.	Total remaining for Manure.	Nitrogen equal Ammonia.	Value of Ammonia at 4d. per lb.
			lb.	%	lb.	lb.	%	lb.	lb.	£ s. d.
1	Linseed	5.0	448.0	3.60	80.64	5.69	7.06	74.95	91.0	1 10 4
2	Linseed-cake	6.0	373.3	4.75	106.40	4.74	4.45	101.66	123.4	2 1 2
3	Decorticated cotton-cake	6.5	344.6	6.60	147.84	4.38	2.96	143.46	174.2	2 18 1
4	Palm-nut cake	7.0	320.0	2.50	56.00	4.06	7.25	51.94	63.1	1 1 0
5	Undecorticated cotton-cake	8.0	280.0	3.75	84.00	3.56	4.24	80.44	97.7	1 12 7
6	Cocoa-nut cake	8.0	280.0	3.40	76.16	3.56	4.67	72.60	88.2	1 9 5
7	Rape-cake	(10)	(224)	4.90	109.76	2.84	2.59	106.92	129.8	2 3 3
8	Peas	7.0	320.0	3.60	80.64	4.06	5.03	76.58	93.0	1 11 0
9	Beans	7.0	320.0	4.00	89.60	4.06	4.53	85.54	103.9	1 14 8
10	Lentils	7.0	320.0	4.20	94.08	4.06	4.32	90.02	109.3	1 16 5
11	Tares (seed)	7.0	320.0	4.20	94.08	4.06	4.32	90.02	109.3	1 16 5
12	Indian corn	7.2	311.1	1.70	38.08	3.95	10.37	34.13	41.4	0 13 10
13	Wheat	7.2	311.1	1.80	40.32	3.95	9.80	36.37	44.2	0 14 9
14	Malt	7.0	320.0	1.70	38.08	4.06	10.66	34.02	41.3	0 13 9
15	Barley	7.2	311.1	1.65	36.96	3.95	10.69	33.01	40.1	0 13 4
16	Oats	7.5	298.7	2.00	44.80	3.79	8.46	41.01	49.8	0 16 7
17	Rice-meal	7.5	298.7	1.90	42.56	3.79	8.91	38.77	47.1	0 15 8
18	Locust-beans	9.0	248.9	1.20	26.88	3.16	11.76	23.72	28.8	0 9 7
19	Malt culms	8.0	280.0	3.90	87.36	3.56	4.08	83.80	101.8	1 13 11
20	Fine pollard	7.5	298.7	2.45	54.88	3.79	6.91	51.09	62.0	1 0 8
21	Coarse pollard	8.0	280.0	2.50	56.00	3.56	6.35	52.44	63.7	1 1 3
22	Bran	9.0	248.9	2.50	56.00	3.16	5.64	52.84	64.2	1 1 5
23	Clover-hay	14.0	160.0	2.40	53.76	2.03	3.78	51.73	62.8	1 0 11
24	Meadow-hay	15.0	149.3	1.50	33.60	1.90	5.65	31.70	38.5	1 12 10
25	Pea-straw	16.0	140.0	1.00	22.40	1.78	7.95	20.62	25.0	0 8 4
26	Oat-straw	18.0	124.4	0.50	11.20	1.58	14.11	9.62	11.7	0 3 11
27	Wheat-straw	21.0	106.7	0.45	10.08	1.36	13.49	8.72	10.6	0 3 6
28	Barley-straw	23.0	97.4	0.40	8.96	1.24	13.84	7.72	9.4	0 3 2
29	Bean-straw	22.0	101.8	0.90	20.16	1.29	6.39	18.87	22.9	0 7 8
30	Potatoes	60.0	37.3	0.25	5.60	0.47	8.39	5.13	6.2	0 2 1
31	Carrots	85.7	26.1	0.20	4.48	0.33	7.37	4.15	5.0	0 1 8
32	Parsnips	75.0	29.9	0.22	4.93	0.38	7.71	4.55	5.5	0 1 10
33	Mangel-wurzels	96.0	23.3	0.22	4.93	0.30	6.09	4.63	5.6	0 2 2
34	Swedish turnips	109.1	20.5	0.25	5.60	0.26	4.64	5.34	6.5	0 1 10
35	Yellow turnips	133.3	16.8	0.20	4.48	0.21	4.69	4.27	5.2	0 1 9
36	White turnips	150.0	14.9	0.18	4.03	0.19	4.71	3.84	4.7	0 1 7

SULTS OF THE ESTIMATION OF THE ORIGINAL MANURE VALUE AFTER CONSUMPTION.

Phosphoric Acid.						Potash.						Total original Manure value per ton of Food consumed.
In Food.		In Fattening Increase at (0.86 per cent).		In Manure.		In Food.		In Fattening Increase at (0.11 per cent).		In Manure.		
Per cent.	Per ton.	From 1 ton of Food.	Per cent of total consumed.	Total remaining for Manure.	Value at 2d. per lb.	Per cent.	Per ton.	From 1 ton of Food.	Per cent of total consumed.	Total remaining for Manure.	Value at 1½d. per lb.	
%	lb.	lb.	%	lb.	s. d.	%	lb.	lb.	%	lb.	s. d.	£ s. d.
1.54	34.50	3.85	11.16	30.65	5 1	1.37	30.69	0.49	1.60	30.20	3 9	1 19 2
2.00	44.80	3.21	7.17	41.59	6 11	1.40	31.36	0.41	1.31	30.95	3 10	2 11 11
3.10	69.44	2.96	4.26	66.48	11 1	2.00	44.80	0.38	0.85	44.42	5 7	3 14 9
1.20	26.88	2.75	10.23	24.13	4 0	0.50	11.20	0.35	3.13	10.85	1 4	1 6 4
2.00	44.80	2.41	5.38	42.39	7 1	2.00	44.80	0.31	0.69	44.49	5 7	2 5 3
1.40	31.36	2.41	7.68	28.95	4 10	2.00	44.80	0.31	0.69	44.49	5 7	1 19 10
2.50	56.00	1.93	3.45	54.07	9 0	1.50	33.60	0.25	0.74	33.35	4 2	2 16 5
0.85	19.04	2.75	14.44	16.29	2 9	0.96	21.50	0.35	1.63	21.15	2 8	1 16 5
1.10	24.64	2.75	11.16	21.89	3 8	1.30	29.12	0.35	1.20	28.77	3 7	2 1 11
0.75	16.80	2.75	16.37	14.05	2 4	0.70	15.68	0.35	2.23	15.33	1 11	2 0 8
0.80	17.92	2.75	15.35	15.17	2 6	0.80	17.92	0.35	1.95	17.57	2 2	2 1 1
0.60	13.44	2.68	19.94	10.76	1 9	0.37	8.29	0.34	4.10	7.95	1 0	0 16 7
0.85	19.04	2.68	14.08	16.36	2 9	0.53	11.87	0.34	2.86	11.53	1 5	0 18 11
0.80	17.92	2.75	15.35	15.17	2 6	0.50	11.20	0.35	3.13	10.85	1 4	0 17 7
0.75	16.80	2.68	15.95	14.12	2 4	0.55	12.32	0.34	2.76	11.98	1 6	0 17 2
0.60	13.44	2.57	19.12	10.87	1 10	0.50	11.20	0.33	2.94	10.87	1 4	0 19 9
(0.60)	(13.44)	2.57	(19.12)	(10.87)	(1 10)	(0.37)	(8.29)	0.33	(4.00)	(7.96)	(1 0)	(0 18 6)
...	...	2.14	...	...	...	...	...	0.27	...	...	...	...
2.00	44.80	2.41	5.38	42.39	7 1	2.00	44.80	0.31	0.69	44.49	5 7	2 6 7
2.90	64.96	2.57	3.96	62.39	10 5	1.46	32.70	0.33	1.01	32.37	4 1	1 15 2
3.50	78.40	2.41	3.07	75.99	12 8	1.50	33.60	0.31	0.92	33.29	4 2	1 18 1
3.60	80.64	2.14	2.65	78.50	13 1	1.45	32.48	0.27	0.83	32.21	4 0	1 18 6
0.57	12.77	1.38	10.81	11.39	1 11	1.50	33.60	0.18	0.54	33.42	4 2	1 7 0
0.40	8.96	1.28	14.28	7.68	1 3	1.60	35.84	0.16	0.45	35.68	4 6	0 18 7
0.35	7.84	1.20	15.31	6.64	1 1	1.00	22.40	0.15	0.67	22.25	2 9	0 12 2
0.24	5.38	1.07	19.89	4.31	0 9	1.00	22.40	0.14	0.63	22.26	2 9	0 7 5
0.24	5.38	0.92	17.10	4.46	0 9	0.80	17.92	0.12	0.67	17.80	2 3	0 6 6
0.18	4.03	0.84	20.84	3.19	0 6	1.00	22.40	0.11	0.49	22.29	2 9	0 6 5
0.30	6.72	0.88	13.10	5.84	1 0	1.00	22.40	0.11	0.49	22.29	2 9	0 11 5
0.15	3.36	0.32	9.52	3.04	0 6	0.55	12.32	0.04	0.32	12.28	1 6	0 4 1
0.09	2.02	0.22	10.89	1.80	0 4	0.28	6.27	0.03	0.48	6.24	0 9	0 2 9
0.19	4.26	0.26	6.10	4.00	0 8	0.36	8.06	0.03	0.37	8.03	1 0	0 3 6
0.07	1.57	0.20	12.74	1.37	0 2	0.40	8.96	0.03	0.34	8.93	1 1	0 3 2
0.06	1.34	0.18	13.43	1.16	0 3	0.22	4.93	0.02	0.41	4.91	0 7	0 2 11
(0.06)	(1.34)	0.14	(10.78)	(1.20)	(0 2)	(0.22)	(4.93)	0.02	(0.34)	(4.91)	(0 7)	(0 2 6)
0.05	1.12	0.13	11.61	0.99	0 2	0.30	6.72	0.02	0.30	6.70	0 10	0 2 7

TABLE III.—(1897) PLAN AND RESULTS OF ESTIMATIONS OF THE COMPENSATION VALUE OF UNEXHAUSTED MANURE, STARTING FROM THE ORIGINAL MANURE VALUE, THAT IS THE VALUE, DEDUCTING THE CONSTITUENTS OF INCREASE IN FATTENING LIVE-WEIGHT ONLY.

FOODS.	Original Manure value, deducting increase in live-weight only.	COMPENSATION VAULE OF UNEXHAUSTED MANURE.							
		Last year.	Second year.	Third year.	Fourth year.	Fifth year.	Sixth year.	Seventh year.	Eighth year.	Total.
DEDUCT ½ OF ORIGINAL MANURE VALUE THE LAST YEAR, AND ⅛ FROM YEAR TO YEAR.										
One Ton	£ s. d.	£ s. d.	£ s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	£ s. d.
1. Linseed	1 19 2	0 19 7	0 13 1	8 9	5 10	3 11	2 7	1 9	1 2	2 16 8
2. Linseed-cake	2 11 11	1 6 0	0 17 4	11 7	7 9	5 2	3 5	2 3	1 6	3 15 0
3. Decorticated cotton-cake	3 14 9	1 17 4	1 4 11	16 7	11 1	7 5	4 11	3 3	2 2	5 7 8
4. Palm-nut cake	1 6 4	0 13 2	0 8 9	5 10	3 11	2 7	1 9	1 2	0 9	1 17 11
5. Undecorticated cotton-cake	2 5 3	1 2 7	0 15 1	10 1	6 9	4 6	3 0	2 0	1 4	3 5 4
6. Cocoa-nut cake	1 19 10	0 19 11	0 13 3	8 10	5 11	3 11	2 7	1 9	1 2	2 17 3
7. Rape-cake	2 16 5	1 8 3	0 18 10	12 7	8 5	5 7	3 9	2 6	1 8	4 1 7
8. Peas	1 16 5	0 18 3	0 12 2	8 1	5 5	3 7	2 5	1 7	1 1	2 12 7
9. Beans	2 1 11	1 0 11	0 13 11	9 3	6 2	4 1	2 9	1 10	1 3	3 0 2
10. Lentils	2 0 8	1 0 4	0 13 7	9 1	6 1	4 1	2 9	1 10	1 3	2 19 0
11. Tares (seed)	2 1 1	1 0 7	0 13 9	9 2	6 1	4 1	2 9	1 10	1 3	2 19 6
12. Indian corn	0 16 7	0 8 4	0 5 7	3 9	2 6	1 8	1 1	0 9	0 6	1 4 2
13. Wheat	0 18 11	0 9 6	0 6 4	4 3	2 10	1 11	1 3	0 10	0 7	1 7 6
14. Malt	0 17 7	0 8 10	0 5 11	3 11	2 7	1 9	1 2	0 9	0 6	1 5 5
15. Barley	0 17 2	0 8 7	0 5 9	3 10	2 7	1 9	1 2	0 9	0 6	1 4 11
16. Oats	0 19 9	0 9 11	0 6 7	4 5	2 11	1 11	1 3	0 10	0 7	1 8 5
17. Rice-meal	(0 18 6)	(0 9 3)	(0 6 2)	(4 1)	(2 9)	(1 10)	(1 3)	(0 10)	(0 7)	(1 6 9)
18. Locust-beans	...	...	...	...	...	...	...	...	...	...
19. Malt culms	2 6 7	1 3 3	0 15 6	10 4	6 11	4 7	3 1	2 1	1 5	3 7 2
20. Fine pollard	1 15 2	0 17 7	0 11 9	7 10	5 3	3 6	2 4	1 7	1 1	2 10 11
21. Coarse pollard	1 18 1	0 19 1	0 12 9	8 6	5 8	3 9	2 6	1 8	1 1	2 15 0
22. Bran	1 18 6	0 19 3	0 12 10	8 7	5 9	3 10	2 7	1 9	1 2	2 15 9
DEDUCT ⅜ OF ORIGINAL MANURE VALUE THE LAST YEAR, AND ⅛ FROM YEAR TO YEAR.										
One Ton										
23. Clover-hay	1 7 0	0 9 0	0 7 2	5 9	4 7	3 8	2 11	2 4	1 10	1 17 3
24. Meadow-hay	0 18 7	0 6 2	0 4 11	3 11	3 2	2 6	2 0	1 7	1 3	1 5 6
25. Pea-straw	0 12 2	0 4 1	0 3 3	2 7	2 1	1 8	1 4	1 1	0 10	0 16 11
26. Oat-straw	0 7 5	0 2 6	0 2 0	1 7	1 3	1 0	0 10	0 8	0 6	0 10 4
27. Wheat-straw	0 6 6	0 2 2	0 1 9	1 5	1 2	0 11	0 9	0 7	0 6	0 9 3
28. Barley-straw	0 6 5	0 2 2	0 1 9	1 5	1 2	0 11	0 9	0 7	0 6	0 9 3
29. Bean-straw	0 11 5	0 3 10	0 3 1	2 6	2 0	1 7	1 3	1 0	0 10	0 16 1
DEDUCT ½ OF ORIGINAL MANURE VALUE THE LAST YEAR, AND ⅛ FROM YEAR TO YEAR.										
Ten Tons										
30. Potatoes	2 0 10	1 0 5	0 13 7	9 1	6 1	4 1	2 9	1 10	1 3	2 19 1
31. Carrots	1 7 6	0 13 9	0 9 2	6 1	4 1	2 9	1 10	1 3	0 10	1 19 9
32. Parsnips	1 15 0	0 17 6	0 11 8	7 9	5 2	3 5	2 3	1 6	1 0	2 10 3
33. Mangel-wurzels	1 11 8	0 15 10	0 10 7	7 1	4 9	3 2	2 1	1 5	0 11	2 5 10
34. Swedish turnips	1 9 2	0 14 7	0 9 9	6 6	4 4	2 11	1 11	1 3	0 10	2 2 1
35. Yellow turnips	(1 5 0)	(0 12 6)	(0 8 4)	(5 7)	(3 9)	(2 6)	(1 8)	(1 1)	(0 9)	(1 16 2)
36. White turnips	1 5 10	0 12 11	0 8 7	5 9	3 10	2 7	1 9	1 2	0 9	1 17 4

On the basis of the figures set out in Tables I. and II. (1897), Lawes and Gilbert constructed a further table in which, beginning with the allowance of one-half the "original manure value" for food consumed during the last year of the tenancy, to the subsequent years, up to the eighth, were assigned compensation values in a regular descending scale, one-third being deducted each year. Thus, with linseed-cake, the "original manure value" being £2, 11s. 11d. per ton (1897), the compensation value for the unexhausted manure from one ton consumed was:—

Last year.	Second year.	Third year.	Fourth year.	Fifth year.	Sixth year.	Seventh year.	Eighth year.
£ s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1 6 0	17 4	11 7	7 9	5 2	3 5	2 3	1 6
(being one-half of the original manure value, £2, 11s. 11d.)	(being the previous year's value less one-third.)	(being the previous year's value less one-third.)	for each year one-third of previous year's value deducted.				

An outgoing tenant would, from this, be able to claim an allowance of 1s. 6d. for each ton of linseed-cake he had consumed seven years previously, there being assumed to be still some slight benefit accruing from it for the eighth crop grown.

In the first of these tables we have the total quantities of ingredients capable of contributing to the fertility of the land contained in the principal varieties of foods in use on the farm, stated both as percentages and as pounds per ton. These figures represent the manurial matter that would reach the land, supposing that the foods were simply ground up and applied directly to the soil, without the intervention of the stock that consumes them.

In Table II. we have indicated to us the average destination of this fertilising matter—how much of it, that is to say, may be assumed to be retained by the animal in increasing its weight, and how much will find its way into the manure. Then we have the theoretical money value of this latter portion calculated for each fertilising constituent; and finally, we have stated what would be the total value of the manure from a ton of the food, supposing its value to be completely realised.

To make the matter clearer, we will select an instance—say that of linseed-cake. From Table I. we learn that linseed-cake contains 88.5 per cent of dry matter, which includes 4.75 per cent of nitrogen, 2.00 per cent of phosphoric acid, and 1.40 per cent of potash; or otherwise stated, one ton of linseed-cake contains 106.40 lb. of nitrogen, 44.80 lb. of phosphoric acid, and 31.36 lb. of potash. From Table II. we learn that 6 lb. of linseed-cake go to make 1 lb. of increase in live-weight, so that 1 ton of cake yields 373.3 lb. of increase in live-weight. We also learn that of the 106.40 lb. of nitrogen in the ton of cake, 4.74 lb. are retained by the animal, while 101.66 lb. pass into the manure. This quantity of nitrogen is equal to 123.4 lb. of ammonia, which, at 4d. per lb., is equal to £2, 1s. 2d. per ton. In like manner we find that of 44.8 lb. of phosphoric acid in the ton of cake, 3.21 lb. are retained by the animal, while 41.59 lb. pass into the manure, which, at 2d. per lb., would be worth 6s. 11d. Of 31.36 lb. of potash in the ton of cake, 0.41 lb. is retained, 30.95 lb. passing into the manure, giving at 1½d. per lb., 3s. 10d. The three money figures added together give £2, 11s. 11d. as the "total original manure value" of one ton of linseed-cake. This value in the case of decorticated cotton-cake is as high as £3, 14s. 9d., while for maize it is but 16s. 7d., or for barley, 17s. 2d., and for swedes it is less than 2s. 11d.

There can be no doubt that the proportions which these "original manure values" bear to one another, correctly represent the proportions borne to one another by the actual manurial values realisable in the field, provided that the circumstances are favourable for their comparative realisation; though it has happened, as in the Woburn experiments, that practical trial has occasion-

ally shown that manure made by the use of a food like decorticated cotton-cake has done no more immediate good than manure made from a like quantity of maize. But this has no doubt been caused partly by the land being in such good heart that the maize manure was in itself sufficient to bring out its maximum fertility, and that the richer manure supplied by the decorticated cotton-cake was of the nature of a superfluity; and partly by the influence of the clover crop in the rotation, which, by taking up nitrogen from the air, tended to equalise the manure residues.

It is of course to be borne in mind that the values calculated in each case are average ones, and any given ton of linseed-cake, for example, may differ a good deal from another ton; but it is only on the *average* quality of each kind of food that a table for general reference could well be based without becoming bewilderingly cumbersome.

Theoretical and Realised Manure Values.—But even putting aside this consideration, there are obviously a vast number of circumstances affecting the question of how far the theoretical value given in the tables is capable of actual realisation in the field. The nearest approach to the perfect application of the whole of the manure to the crops is found in the consumption of food on the land itself, as when grazing cattle or sheep consume cake in the field. Their excreta go directly on to the land, and so the whole of the manurial matter at least reaches the soil.

The other extreme is found where the food is consumed in the farmyard, and the manure badly cared for—as when it is left to lie about in the open, exposed to the free and prolonged action of rain, in such a way as to allow the drainage from it to be lost. Wherever the rich drainings from dung are allowed to run to waste, there is a serious loss of fertilising matter,—for the most valuable part of manure is the soluble salts of ammonia and potash which it contains.

What proportion of the manurial value originally contributed to the dung really finds its way on to the land from the farmyard depends, therefore, upon individual care and management, of which no exact account can be taken in tables.

Furthermore, a herd of dairy cows will rob the food of much more nitrogen and phosphoric acid than a herd of fattening oxen, since oxen, while fattening, store up but little of these materials compared with that which is required by the cows to produce a flow of milk, and to build up the bodies of the young calves which they have yearly to produce. The same applies to the case of young growing stock as compared with fattening stock, the former storing up more of the food-materials, and producing consequently the poorer manure. There are obviously, then, difficulties to be surmounted in forming an estimate of the manurial value that may fairly be assumed to be realisable in any given case.

To meet in some way these difficulties, Lawes and Gilbert published in the *Journal of the Royal Agricultural Society of England* for 1898 a revision of their already quoted tables, in which these are made specially applicable to the case of cows producing milk.

As a guide to the farmer in regard to the value of the respective foods, and as to the best foods to use in order to at once fatten his stock and best fertilise his land, the mere "original manure values" supply sufficient information; but when the question at issue is the realisable unexhausted value of manure from food consumed, such complexities as we have glanced at arise and give serious trouble.

Unexhausted Value of Consumed Food.—The "county customs" which are often brought in to assess, under the provisions of the Agricultural Holdings Act, the compensation due to an outgoing tenant for unexhausted manurial value for foods consumed, are in most cases absurdly fallacious, being too often based on the *cost* of the foods used, this having really no relation whatever to their manurial value. The difficulty which the valuer who proceeds on rational principles has to face is to decide on how much of the "original manure value" is to be assumed to be still left on the farm—the "compensation value," as Sir John Bennett Lawes has called it.

With a view to putting the matter on a broad general basis for practical purposes, Lawes and Gilbert drew up a further table (Table III.), in which they

suggested that in the case of an outgoing tenant claiming compensation for the unexhausted value of consumed food, the "original manure value" of each ton of food (as shown in Table II.) should be discounted to the extent of 50 per cent for the food consumed within the last year. This deduction of 50 per cent was in order to allow for all the losses to which the manure was subject before it came to be actually applied to the land. The compensation was further spread over a period of eight years, for which period it was assumed to exercise an influence. In the case of food consumed in the last year but one, a deduction was made of one-third of the allowance for the previous year—while for food consumed three years previously a further deduction of one-third was made; and so on, for any particular number of years, down to the eighth year.

Let us, as an instance, take again the case of linseed-cake, the "original manurial value" of which is £2, 11s. 11d. For each ton of this cake consumed in the last year of tenancy, it would be assumed that a practical unexhausted value of £1, 6s. remained on the farm, realisable by the new tenant. For a ton of cake consumed in the last year but one, this sum would be reduced by one-third, making 17s. 4d. If consumed a year previously, it would be still further reduced by a third, making 11s. 7d., and so on. In the eighth year back, the compensation would be only 1s. 6d.

As a matter of fact, most farmers would, no doubt, object to paying "compensation values" for food used more than two or three years previously; but the principle of compensation suggested—taking it as far back as may be deemed judicious—is a perfectly sound one. In applying it, the valuer, if he knows his business, will be influenced by his observations taken on the farm as to the mode in which manure is treated, and as to the information available in regard to the consumption of the food. Sir John Bennett Lawes and Sir Henry Gilbert, in the paper already quoted from, very rightly observe: "It is pretty certain indeed that every claim for compensation will have to be settled on its own merits; that the character of the soil, the cropping, the state of the land as to cleanliness, and many other points, will be taken into consideration both for and against any claim."

Voelcker and Hall's Tables.

What Lawes and Gilbert's Tables really effected was, to put the whole matter of the valuation of unexhausted manurial residues on a sound basis—viz., that of the value of the actual constituents supplied and not the mere cost of the foods producing them, this latter, as explained, having often no relation whatever to the manurial value. Previously to the issue of these tables the assessing of "unexhausted value" had been ruled entirely by "local custom," this varying very widely in different districts. Each system, moreover, was of a purely arbitrary character, and in almost every instance the actual *cost* of the respective foods was taken as the starting-point. Lawes and Gilbert's Tables rightly superseded these "local systems," and supplied, at least, a reasonable ground on which to frame a valuation.

At the same time, it was generally felt that, in practice, the period of eight years, over which Lawes and Gilbert spread the application of their system, was an unduly long one. Undoubtedly it could be shown from the Rothamsted and the Woburn experiments that manure made from purchased foods would exercise an influence for as long a period as eight years on crops subsequently grown with it, but there was the fact to consider that no one would, in practice, apply farmyard manure only at such long intervals, nor would any one expect it to have any practical bearing after so long a period as eight years after its first application.

Such considerations as these militated much against the general adoption of Lawes and Gilbert's Tables in the practical business of valuation, and, though the general principles of the tables were in a measure accepted, and though certain modifications were introduced into "local systems" consequent on these, the latter were not by any means wholly superseded. There was a general feeling, in short, that the tables, though perhaps they were right

in principle, could not be fully applied in practice.

These facts led Dr J. A. Voelcker and Mr A. D. Hall—the then directors respectively of the Woburn and Rothamsted Experimental Stations—to review the whole position, and in 1902 they put forward a revision of Lawes and Gilbert's Tables, and this was published in the *Journal of the Royal Agricultural Society of England* for 1902. This table is here set out at length.

TABLE IV.—VOELCKER AND HALL'S TABLES (1902) OF THE COMPOSITION, MANURIAL AND COMPENSATION VALUES OF FEEDING-STUFFS (REVISED FROM LAWES AND GILBERT'S TABLES OF 1897).

No.	Foods.	Valuation per Ton as Manure.								Compensation value for each ton of the food consumed.			
		Nitrogen.			Phosphoric acid.			Potash.					
		Per cent in food.	Value at 12s. per unit.	Half of value to manure.	Per cent in food.	Value at 3s. per unit.	Three quarters of value to manure.	Per cent in food.	Value at 4s. per unit, all to manure.	Last year.	Second year.	Third year.	Fourth year.
		%	s. d.	s. d.	%	s. d.	s. d.	%	s. d.	s. d.	s. d.	s. d.	s. d.
1	Decorticated cotton-cake	6.90	82 10	41 5	3.10	9 4	7 0	2.00	8 0	56 5	28 2	14 1	7 0
2	Undecorticated cotton-cake	3.54	42 6	21 3	2.00	6 0	4 6	2.00	8 0	33 9	16 10	8 5	4 2
3	Linseed-cake	4.75	57 0	28 6	2.00	6 0	4 6	1.40	5 7	38 7	19 3	9 7	4 9
4	Linseed	3.60	43 2	21 7	1.54	4 7	3 5	1.37	5 6	30 6	15 3	7 7	3 9
5	Palm-nut cake	2.50	30 0	15 0	1.20	3 7	2 8	0.50	2 0	19 8	9 10	4 11	2 5
6	Cocoa-nut cake	3.40	40 10	20 5	1.40	4 2	3 1	2.00	8 0	31 6	15 9	7 10	3 11
7	Rape-cake	4.90	58 10	29 5	2.50	7 6	5 8	1.50	6 0	41 1	20 6	10 3	5 1
8	Beans	4.00	48 0	24 0	1.10	3 4	2 6	1.30	5 2	31 8	15 10	7 11	3 11
9	Peas	3.60	43 2	21 7	0.85	2 7	1 11	0.96	3 10	27 4	13 8	6 10	3 5
10	Wheat	1.80	21 7	10 9	0.85	2 7	2 0	0.53	2 1	14 10	7 5	3 8	1 10
11	Barley	1.65	19 10	9 11	0.75	2 3	1 8	0.55	2 2	13 9	6 10	3 5	1 8
12	Oats	2.00	24 0	12 0	0.60	1 10	1 5	0.50	2 0	15 5	7 8	3 10	1 11
13	Maize	1.70	20 5	10 2	0.60	1 9	1 4	0.37	1 6	13 0	6 6	3 3	1 7
14	Rice-meal	1.90	22 10	11 5	0.60	1 9	1 4	0.37	1 6	14 3	7 1	3 6	1 9
15	Locust-beans	1.20	14 5	7 2	0.80	2 5	1 10	0.80	3 2	12 2	6 1	3 0	1 6
16	Malt	1.82	21 10	10 11	0.80	2 5	1 10	0.60	2 5	15 2	7 8	3 10	1 11
17	Malt culms	3.90	46 10	23 5	2.00	6 0	4 6	2.00	8 0	35 11	17 11	8 11	4 5
18	Bran	2.50	30 0	15 0	3.60	10 10	8 2	1.45	5 9	28 11	14 5	7 2	3 7
19	Brewers' grains (dried)	3.30	39 7	19 9	1.61	4 10	3 8	0.20	0 10	24 3	12 1	6 0	3 0
20	Brewers' grains (wet)	0.81	9 9	4 11	0.42	1 3	0 11	0.05	0 2	6 0	3 0	1 6	0 9
21	Clover-hay	2.40	28 10	14 5	0.57	1 9	1 4	1.50	6 0	21 9	10 10	5 5	2 8
22	Meadow-hay	1.50	18 0	9 0	0.40	1 2	0 11	1.60	6 5	16 4	8 2	4 1	2 0
23	Wheat-straw	0.45	5 5	2 8	0.24	0 9	0 7	0.80	3 2	6 5	3 2	1 7	0 9
24	Barley-straw	0.40	4 10	2 5	0.18	0 6	0 4	1.00	4 0	6 9	3 4	1 8	0 10
25	Oat-straw	0.50	6 0	3 0	0.24	0 9	0 7	1.00	4 0	7 7	3 9	1 10	0 11
26	Mangels	0.22	2 8	1 4	0.07	0 3	0 2	0.40	1 7	3 1	1 6	0 9	0 4
27	Swedes	0.25	3 0	1 6	0.06	0 2	0 1	0.22	0 11	2 6	1 3	0 7	0 3
28	Turnips	0.18	2 2	1 1	0.05	0 2	0 1	0.30	1 2	2 4	1 2	0 7	0 3

In drawing up this revised table, Voelcker and Hall were able to utilise information obtained from further experiments conducted at Woburn and Rothamsted as well as on the Continent, and these were specially useful as affording more definite knowledge as to the actual losses incurred in making and storing farmyard manure. Up to that time these losses had been merely assumed, but now they were able to be more nearly defined.

Further, the tables were revised in two important respects: firstly, in respect

of the money values of the manurial constituents, these having undergone some modification since the earlier tables were issued; and, secondly, in regard to the period over which compensation was spread. Voelcker and Hall limited this period to that of the ordinary farm rotation—viz., four years—substituting this for the eight years adopted by Lawes and Gilbert, and adjusting the tables in this sense. In addition to these alterations, they simplified the tables by the exclusion of certain foods which only very occasionally came under consideration, and, in place of the three tables of Lawes and Gilbert, they put forward a single table (Table IV.), which comprised practically all the details that were necessary for showing the basis of calculation and the final valuation of the unexhausted residue for each year of the rotation.

In arriving at their conclusions, Voelcker and Hall, it must be understood, closely followed the principles laid down by Lawes and Gilbert, adopting, in great measure, the figures of these investigators as to the composition of foods, the constituents stored up in live-weight increase, &c. The main differences were in regard to the losses in making and storing the manure (these being now based on actual experiment), and in respect of the period over which compensation was to be spread.

Simultaneously with this revision by Voelcker and Hall, the Central Chamber of Agriculture, which had appointed a Committee for the purpose, and had received evidence from valuers, farmers, and others, issued a table for the assessment of unexhausted value. This Table, it may be said, differs but slightly from that of Voelcker and Hall. The tables put forward by the latter have been very favourably received, and may be said to have practically superseded the "local systems" formerly in use; they have now secured general adoption, and may be taken as ruling the question of "compensation for unexhausted manure value of foods."

TREATMENT OF FARM-HORSES.

As would be expected, the management of the work-horses of the farm differs in many details from the system pursued in pure-bred studs. In the former case the methods are more simple and less varied.

In the greater part of England, horses when not at work are tended by lads or men employed specially for the purpose. In Scotland and Ireland it is the prevailing custom for the men who work the horses to attend at all times to their feeding and general treatment. The latter system is the better one for both men and horses.

Watering Horses.—The first attention to horses in the morning is to take them out to water—that is, if there is not a regular supply of water within their reach in the stable.

When horses are allowed to drink water freely immediately after feeding, they are liable to suffer from colic, as the water is apt to carry some of the undigested food into the intestines. Water should therefore always be given to horses before, and not after, feeding.

The quantity of water drunk by horses varies greatly, some drinking more than others. If allowed frequent access to fresh pure water, horses will not, as a rule, drink more than necessary. When an animal is very hot, or chilled, or exhausted, or has been long without water, only a small quantity of water should be allowed at first. In such cases, a safe drink is water thickened with a handful or two of oatmeal, or, better still, oatmeal gruel. Very cold water should be given in small quantities at a time. Keep watering-troughs scrupulously clean, and see that the water in them is changed frequently.

When the horses have received their morning feed, the men, before going to breakfast, remove the dung and soiled litter to the dung-pit.

Morning Feed.—Immediately after getting water, the horses receive their

first allowance of bruised oats or other food, with long hay in the rack or manger, the latter being usually preferred. Horses should be given peace at feeding-time. Harness can be quickly enough put on after the feed is eaten, and time should be taken to groom the horses very carefully. An allowance of a little time between eating and going to work is of advantage to all horses.

Mid-day Care of Horses.—When the horses come in from the morning work they get a drink of water, a feed of bruised corn, and chaffed hay or oat-straw, and the men get their dinner. Some keep the harness on during this interval, but it should be taken off, to allow both horses and harness to cool. After dinner the men return to the stable, when the horses will have finished their feed, and a small ration of fresh straw or hay will be well relished. The men have a few minutes to spare, when they should wisp down their horses, put on the harness, comb out the tails and manes, and be ready to put on the bridles the moment one o'clock strikes.

When work is in a distant field, rather than take them home between yokings, some farmers feed the horses in the field out of nose-bags, and make the men take their dinners with them, or it is brought to them. This, however, is not a good plan.

Hours of Work.—The hours of work vary in different parts of the country, and, of course, also with the season. The most general rule is ten hours per day—from six to eleven A.M. and one to six P.M. In Scotland this method is strictly adhered to, when daylight admits, but in England there is less regularity in working hours.

Work expected of Horses.—No definite rules can be laid down as to the amount of work which should be accomplished by horses. The local circumstances, such as the character and fitness of the horses, the nature of the work, the exigencies of the time, and the supply of food, must always be duly considered, and the farmer must at the time decide for himself how much work of any particular kind he is to expect from each horse or pair of horses.

One general principle may be laid down—one not so fully observed as is desirable—and that is, that in working horses long days are preferable to quick pace. It will be much easier for a pair of horses to plough a certain equal extent of land in six days of ten hours than in six days of nine hours each, easier still than in six days of eight hours. With the farm-horse, as with the roadster and hunter, "it is the pace that kills."

Evening Care of Horses.—When the horses come in from their day's work they are well rubbed down, and receive hay or straw and bruised oats. The stable has had but half litter all day, since its cleansing out in the morning, and the horses have stood on the stones at mid-day. This is a good plan for purifying the stable during the day, and is not so much attended to as it deserves. Fresh straw is brought by the men from the straw-barn, and shaken up with the old litter to make the stalls comfortable for the horses to lie down upon for the night. In most cases horses receive food again about eight o'clock, when the litter is once more shaken up and adjusted for the night.

Grooming Horses.—The grooming consists first in currying the horse with the curry-comb *b*, fig. 738, to

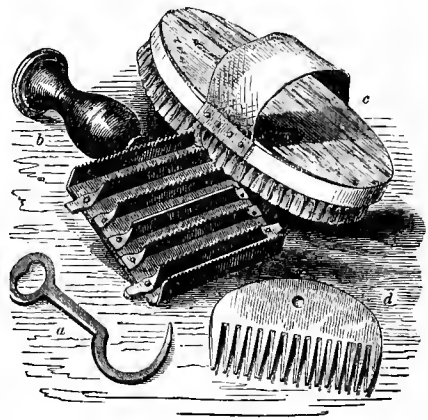


Fig. 738.—*Curry-comb, brush, foot-picker, and mane-comb.*

free him of the dirt adhering to the hair, and which, being now dry, is easily removed. A wisping of straw removes the roughest of the dirt loosened by the curry-comb. The legs ought to be thoroughly wisped—not only to make them

clean, but to dry up any moisture that may have been left in the evening. At this time the feet should be picked clean, by the foot-picker *a*, of any dirt adhering between the shoe and foot. The brush *c* is then used to remove remaining and finer portions of dust from the hair, dust being cleared from the brush by a few rasps along the curry-comb. The wisping and brushing, if done with some force and dexterity, with a combing of the tail and mane with the comb *d*, should render the horse pretty clean. But there are more ways than one of grooming a horse, as may be witnessed by the skimming and careless way in which some ploughmen do it. It is the duty of the farmer himself, or his steward or manager, to see that the horses are well attended to.

Brushing preferable to Combing.—The use of the iron curry-comb is disapproved by many. Dr Fleming says it "should never, as a rule, be applied to the skin of horses." For long rough coats, he considers nothing is better than a good dandy-brush to remove dandruff, dust, and dirt; for finer-coated horses a good bristle-brush, supplemented by the wisp and rubber, will suffice. He regards the brush as the best appliance for cleaning the skin thoroughly, and he points out how essential it is, for the health of the animal, that the skin be kept clean, so that it may at all times be in a fit condition to perform its important functions.

Rubbing Wet or Heated Horses.—If a horse comes into the stable heated or wet, it should at once be well rubbed down with a handful of straw. If it has been excessively warm, it may be well to throw a rug over it till it has regained its normal temperature. It may perhaps, after two or three hours, or sooner, break out into a cold perspiration, and if so it should again be well dried.

Water-brush.—For washing the legs and heels of a horse, a water-brush, fig. 739, is very useful.

Exercise for Horses.—When idle, work-horses should be taken out for exercise every day, and groomed as carefully as when at work. Exercise is necessary to prevent thickening of the heels, a "shot of grease," or a common cold. Fat horses, unaccustomed to exercise, are liable to molten grease.

Breeding Horses.—It is advisable for most farmers to breed their own horses. On a farm which employs three, four, or more pairs, two mares might easily bear foals every year, and perform a share of the work at the same time, without injury to themselves.

Wintering Young Horses.—In the south of England young horses are kept out on the fields all the year round, and in many cases do not even have a shed in which to lie overnight. Most people consider it necessary to have field-sheds for shelter, but in some cases nothing of the kind is provided.

Housing Necessary in Cold Districts.—But in the colder districts the young as well as the adult horses have to be housed in winter, at any rate overnight. When the weather is not wet or very cold the young animals should have

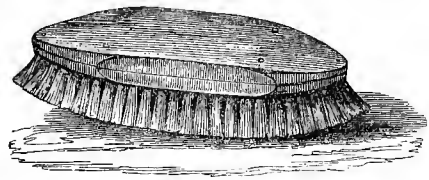


Fig. 739.—*Water-brush.*

a run out daily, and be brought back to a dry but airy bed at night. Covered sheds afford excellent shelter for young horses in winter nights, and where these are not available, loose-boxes or hammels are preferable to stalls.

Handling Young Horses.—Young horses should be frequently handled by their attendant, who by his kindly handling should make himself welcome and familiar amongst them. Young horses are not regularly groomed, but they will be all the better of a turn of the brush now and again. They should be rubbed with straw, if wet, and any clay or earth adhering to their hair should be removed.

Colts and fillies may be kept together their first winter, but afterwards entire colts should be kept by themselves.

Intelligence of Horses.—The horse is an intelligent animal, and seems to delight in the society of man. It is remarked by those who have much to do

with blood-horses, that when at liberty, and seeing two or more persons standing conversing together, they will approach, and seem to wish to listen to the conversation. The farm-horse will not do this; but he is quite obedient to call, and recognises his name readily from that of his companion, and will not stir when desired to move until *his own name* is pronounced. He discriminates between the various sorts of work he has to do, and will apply his strength or skill in the best way, whether in the threshing-mill, the cart, or the plough. He will walk very steadily towards a feering-pole, and halt when he has reached it. He seems also to have an idea of time. We have heard a horse neigh daily about 10 minutes before the time of loosening from work in the evening, whether in summer or winter. He is capable of distinguishing the tones of the voice, whether spoken in anger or otherwise.

Horses are fond of nearly all kinds of music. Work-horses have been known, even when at their corn, to desist eating, and listen attentively, with pricked and moving ears and steady eyes, to music on various instruments. We have seen a kilted Highlander playing the bagpipes riding on the back of a farm-horse, which showed every sign of pleasure. The recognition of the sound of the bugle by a trooper, and the excitement occasioned in the hunter when the pack give tongue, are familiar instances of the power of particular sounds on horses, in recalling old associations to their memory. The horse's memory is very tenacious, as is evinced in the recognition of a stable in which he had at times been well treated. He is very susceptible of fear, and will refuse to pass into a road or a particular locality in which he had received a fright.

FEEDING HORSES.

In its way, the feeding of horses is quite as important as the feeding of cattle. The one is fed to perform work, the other to produce meat. In each case the performance will depend mainly upon how the matter of feeding has been attended to. He who would feed his horses perfectly must know and consider not only the duties, powers, condition, and consequent food requirements of each animal, but also the composition and character of the available articles of food. It is only by properly adapting the one to the other that he can ensure the best possible results. Perfection may be beyond our reach. Let us get as near to it as possible.

Articles of Food for Horses.—The articles of food most largely used for horses are hay, straw of various kinds, oats, wheat, barley, beans, Indian corn, bran, linseed, linseed-cake, turnips, mangels, carrots, parsnips, potatoes, furze (or gorse), silage, vetches, fresh grass, clover, &c. Information regarding the composition and character of these and other feeding materials is given in the section on "Varieties of Food" (vol. iii. p. 269), in this volume. Before attempting to arrange mixtures of food for horses, farmers should give careful consideration not only to that information, but also to what is said in the succeeding section on "Animal Nutrition" (vol. iii. p. 291).

Food Requirements of Horses.

It is far from easy properly to understand and determine the food requirements of different horses—horses of various kinds, ages, conditions, and sizes, and performing different kinds of work.

Ration for Idle Horses.—For a horse doing no work, the food, to properly maintain its bodily functions for twenty-four hours, should contain over 12 lb. dry matter, made up as follows:—

Albuminoids . . .	8.36 oz.
Fats	3.19 "
Carbohydrates . .	11.4 lb.
Salts	0.5 oz.

Total food, free from water, 12.15 lb.

It is calculated that this amount of food, so composed, is capable of prodncing force equal to 27,855 foot-tons. "And if the weight of a horse," says Dr Fleming, "is estimated at 1000 lb., he would require 87.3 grains for each pound of body weight; or the whole body would require about 1-80th part of its weight in food every twenty-four hours, the animal undergoing no toil of any kind. A pony weighing 440 lb. requires 46 grains of nitrogenous matter for each 2 lb. 3¼ oz.

of weight. This essential diet is supposed to be theoretically totally devoid of water, but in reality it would contain from 15 to 20 per cent of that fluid; so that, to allow for it, something like 1.87 lb. to 2.49 lb. must be added to the 12.472 lb."[1]

But this is merely a ration for the bare subsistence of a horse. To enable the horse to perform work, additional food is necessary.

Additional Food for Work.—The amount of additional food required to enable a horse to perform work and maintain its condition will depend upon several circumstances, such as the nature and amount of work to be done, the season of the year, condition and size and powers of the horse, &c. The mere weight of the animal is not so reliable as a guide to the quantity of food required by a horse as it is in the case of cattle. The food requirements of small horses are relatively greater than those of larger ones.

Quick Pace and Food Requirement.—A point of some importance is this, that there is less waste of energy and tissue—and therefore less food requirement—when the labour performed is slow and prolonged than when it is brief and severe. Dr Fleming says it has been calculated that the useful work of a horse, which would be represented by 100, with a velocity of 2 miles per hour, would not be more than 51 with a velocity of 7½ miles, or more than 7 with a speed of 11½ miles an hour. In practice it has been found that the amount of food sufficient for slow work for ten hours will not suffice for more than five hours' exertion at a trot. Increased speed in work increases the demand for albuminous food.

A horse working at walking-pace requires from 6 to 9 grains of albuminoids for each 7233 foot-pounds of work performed; while for work at a trot the requirements of albuminoids would be as much as from 15 to 24 grains for the same number of foot-pounds of energy expended.

Force exerted by Horses.—In order to know how to properly adjust the quantity and composition of food, it is necessary to ascertain as nearly as possible the amount of force exerted by horses in performing work, be it pulling a load or carrying a rider. With regard to this Dr Fleming says: "It may be mentioned that a one-horse engine, working ten hours per day, raises 19,799,360 pounds 1 foot high—this being the calculated amount of energy expended in ten hours if it could be all at once exercised. But this is probably much more than a horse could exert; a very hard day's work would in all likelihood not be more than 16,400,000 foot-pounds, which would be exercised by a horse pulling a load along at a walk for eight hours. Eight hours' slow walking, with a traction force of 100 lb., is equal to 8,436,571 foot-pounds per day. Slow farm-work is equal to 11,211,000 foot-pounds per day. With regard to fast work, the amount of foot-pounds raised is less, for the effort required is sudden, and the waste of tissue or force is consequently greater. The actual amount of work done is less, for the reason that the animal cannot sustain the effort, and owing to the greater waste incurred, more food is needed."

The amount of energy expended at work both at fast and slow pace must vary considerably, but Dr Fleming gives the following estimate as "fairly correct":—

	Foot-pounds.
A hard day's work for a horse at a walk would be	11,500,000
A moderate day's work, ditto .	8,500,000
A hard day's work for a horse at a trot of fast pace would be	7,233,000
A moderate day's work, ditto .	3,500,000

Rations for Degrees of Work.—The following table, showing the amount of food required by a horse under different conditions of labour—the proximate principles of the diet being stated—is given by Dr Fleming:—

Proximate Principles.	Moderate Work.		Active Work.		Severe Work.	
	lb.	oz.	lb.	oz.	lb.	oz.
Albuminoids .	1	4	1	8	2	0
Fats . .	0	8½	0	10	0	12½
Carbohydrates	6	13	6	0	10	0
Salts . .	1	5	1	7	1	9
Total .	9	14½	9	9	14	5½

[1] *The Practical Horse-Keeper.*

It is necessary to explain that these are merely approximate quantities, and must not be followed blindly. In each individual case carefulness and judgment must be exercised; and the appetite, health, condition, and working powers of each animal duly considered.

Winter Feeding of Horses.

There is almost as much variety in the systems of feeding horses in winter as in the methods of the winter feeding of cattle.

As to the methods of feeding different classes of horses so much information has already been given in describing the systems of management pursued in pure-bred studs of the various breeds of horses and ponies, that comparatively little need be added here.

Preparing Food for Horses.—On the best-managed farms all kinds of grain are bruised, and the larger portion of the hay and straw cut into chaff before being given to horses. As to the propriety of bruising grain there can be no question. Not an ounce of grain of any kind should be given to horses without being ground; for when given whole, a portion of the grain is liable to pass through the animals undigested. The husk of grain is so dense and difficult to dissolve, that if it should be given whole and escape being ground by the animal's teeth, the gastric juice acts feebly and slowly upon it, and will most likely be unable to dissolve it, so that a portion of the whole grain will pass through the animal unaltered.

As to the chaffing of hay and straw, there is some difference of opinion. But there is no doubt the chaffing both economises fodder and is advantageous to the horses, by assisting them to masticate their food. It should therefore be encouraged, for both these points are important.

Many who regularly pursue chaffing give their horses in addition small allowances of long hay or straw, which may be relished by the horses when they are not hard worked and have plenty of time to eat their food. The bruised grain and chaffed fodder are usually given together, and are of course mixed in varying proportions according to the work being performed at the time. Beans and peas should be merely cracked or split, and not ground into flour. Care should be taken to mix the various ingredients thoroughly, so that each animal may receive its due proportions of all of them. The chaffed fodder and bruised grain may be conveniently mixed in a large iron vat or box, or in a wooden box lined with sheet-iron.

Mashes for Horses.—Farmers now, as a rule, prefer dry food to mashes for horses, but in many cases in winter mash is still given once or twice a-week. The mash generally consists of boiled barley, oats, or beans, mixed at times with bran and seasoned with salt, and an ounce each of sulphur and nitre is sometimes added. Raw potatoes or swedes are given one time and mash another, or the potatoes and swedes are boiled with either barley or oats. The articles are prepared in the stable boiler-house in the afternoon, and when given to the horses at night should not exceed milk-warmth. The corn put into the boiler is as much as when given raw, and in its preparation swells out to a considerable bulk. The horses are exceedingly fond of mash. The ingredients should be well mixed and well cooked.

For horses at light work, cooking food may be commended on the score of economy, for a small allowance of cooked grain will render a large quantity of chaffed fodder palatable. For horses, old or young, whose teeth and digestive systems are weak or defective, cooked food is highly advantageous. Mouldy hay is made safer and more palatable by being steamed, and damaged grain should in all cases be cooked. Horses will relish a sprinkling of salt in their cooked food. Be careful to give the cooked food to horses before it begins to ferment.

Oats for Horses.—The quantity of raw bruised oats given to farm-horses, when at moderate work, is usually from about 7 to 12 lb. per day in two or three feeds. Some give less when the horses are not at full work. Others give still larger quantities in the busy season.

Substitutes for Oats.—Some farmers withdraw the corn altogether from their horses in the depth of winter, giving them mashes of some sort instead; whilst others give them only one feed of

oats a-day, divided at morning and noon, and a mash or raw turnips or potatoes at night. In many cases the mashes used when horses are at light work consist too largely of chaffed straw, upon which horses soon lose condition and strength. A fair proportion of grain of some kind should always be included.

Both turnips and potatoes are good food for horses, but they should be given in moderation. Large quantities of soft food do not prepare horses well for hard work, and so mashes should be given to them sparingly.

A Group of Rations.—The following are food mixtures used by leading farmers in different parts of the country when horses are at full work, the quantities mentioned being for one day:—

(1) 10 lb. of cut straw; 10 lb. of oats; 16 lb. of turnips.

(2) 16 lb. of hay; 5 lb. of oats; 16 lb. of turnips.

In these two cases the turnips are pulped and mixed with the cut fodder twelve hours before being used.

(3) 10 lb. of bruised oats; 20 lb. of hay; 12 lb. of cut straw.

(4) Hay, maize, oats, and beans, mixed in the proportions of 4 cwt. hay, 3 cwt. maize, 2 cwt. oats, and 1 cwt. beans—the hay being chaffed and the grain bruised. Heavy farm and cart horses, doing full work, get as much of this mixture as they will eat, which is about 24 lb. each daily, with a little long hay twice a-day.

(5) 2 bushels of oats, ½ bushel split peas, with 2 trusses of hay and straw chaffed per week per head when in full active work.

(6) As much as they can eat of long straw and uncut swedes, with 1½ bushel oats per week.

(7) 18 lb. crushed oats and 2 lb. linseed-cake, with hay *ad lib.*

(8) 12 to 14 lb. crushed oats; a mash of bran, with a gill of linseed-oil and some saltpetre every Saturday night; an allowance of hay and oat straw *ad lib.*

(9) 10½ lb. crushed oats, 5½ lb. crushed Indian corn, and 7½ lb. cut hay, with long hay *ad lib.*, and rock-salt to lick.

(10) 13 lb. of crushed oats, 3 lb. bran, 6 lb. raw swedes (sliced), and 14 lb. cut chaff (two-thirds hay and one-third straw)—the oats, bran, and chaff being mixed together and macerated with water, and prepared twelve hours before being used.

In most cases these rations, which apply to the winter and spring, cost from 10s. to 12s. per week; in some cases more. In the grazing season the rations are varied and greatly lessened, especially in grain.

Roots for Horses.—Swedes, either raw or cooked, are given largely to draught-horses. When the roots are cooked alone, from 50 to 60 lb. are put into the boiler or steaming-vat for each horse, and this gives about 35 to 45 lb. of cooked food, which should be prepared in time to allow it to become cool, but not cold, before being given to the horses in the evening. A little chaffed hay, perhaps not more than 1 lb. for each horse, is mixed with cooked roots, and some add about 1 lb. of ground oilcake, while others have about half a pound linseed for each animal cooked along with the roots. This warm food is given either in two meals—one when the horses come in from work in the evening, and the other at 8 P.M.—or in one meal at the latter hour.

But the most general plan is to give the turnips to horses raw and uncut, as the last meal for the night. Mangels are given in a similar way. Roots of all kinds should be thoroughly cleaned before being given to horses.

Carrots and Parsnips.—There is no kind of root equal to carrots for horses. They are especially suitable for hunting and other horses which are hard-worked. They are given raw and usually sliced. For ordinary farm-horses, however, they are generally beyond reach on account of their cost. Parsnips are also given to horses. Both carrots and parsnips are supposed to be injurious to the eyes of horses.

Furze for Horses.—Furze (whin or gorse) is relished by horses, and makes useful winter food for them. It is the young shoots of furze that are fed to horses, and they are best when bruised by a furze "masticator." In the absence of a "masticator," the furze is cut as fine as possible by a chaff-cutter, but this does not cut and bruise it so fine as is desirable. A hand furze-bruiser, which does its work wonderfully well, is

represented in fig. 740. When fresh furze is crushed, it throws off a fine aromatic odour, which is much relished by horses. The furze is bruised every second or third day. It should not be allowed either to heat to any extent or to become dry. If it should get dry before being used, it would be well to sprinkle water over it by a garden watering-can.

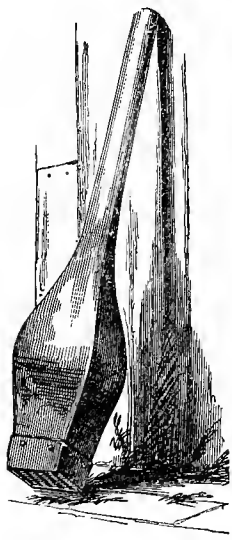


Fig. 740.—*Hand whin-bruiser.*

Draught-horses will eat from 20 to 25 lb. of crushed furze per day, but it will be as well to give smaller quantities, mixed with chaffed hay or straw and bruised oats.

Feeding Young Horses. — Young growing horses are often stinted in food. No greater mistake could be made. They ought to be fed liberally and with as much care and punctuality as the hardest-worked horse on the farm. Let them have as much good hay or oat-straw as they can eat two or three times a-day. In addition to this, on many farms one-year-olds get 3 lb., and two-year-olds 4 lb., gradually increasing as they get bigger to 5 lb., of the following mixture: 3 parts crushed oats, 1 part beans, and 1 part linseed,—this food being given when the animals are housed at night, and before being put out in the morning. In wet stormy days, when they are out only half an hour or so for exercise, they should have their food thrice, instead of twice a-day.

This is liberal feeding, and less of the concentrated food, perhaps from 4 to 6 lb. per day, may suffice to keep the youngsters growing and in good condition. Many think it is desirable to give young horses once or twice a-week a warm mash, consisting of boiled roots, boiled linseed or linseed-meal, mixed with bran. Young horses will thrive admirably on 3 to 4 lb. of crushed oats, and 1 lb. of crushed linseed-cake per day, mixed with chaffed hay or straw, and raw swedes.

Young Horses not to be Pampered. —But while young horses should be fed liberally, they should not be forced in feeding, or pampered in any way. Keep them in good growing condition, full of natural flesh; and, without exposing them to excessive cold or wet, let them have plenty of exercise and fresh air, so that, as far as possible, their muscular and constitutional strength and hardiness may be developed.

Rations for Town Horses. — The rations given to horses for town haulage vary greatly, the following indicating usual allowances for light and medium van and lorry horses in the towns named:—

	Glasgow.	Edinburgh.	Birmingham.	London, South.	London, Street.	Liverpool.	Dublin.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Oats	6	8	10	7	3	...	3
Maize. . . .	11	4	6	7	12	12	14
Beans or peas . .	...	4	4	1	1	4	...
Hay	8½	14	12	11	11	14	12
Straw . . .	1	2	...	3	...	...	...
Bran	0½	...	...	...	1	1	0½
Total lb. . .	27	32	32	29	28	31	29½

Riding and Driving Horses.—Carriage-horses are often fed more highly than is necessary or is really beneficial for their health and usefulness. If their work is light, from 8 to 10 lb. of bruised grain and 12 to 14 lb. of chaffed hay per day will be sufficient. When the work is heavier the grain must be increased, perhaps 2 or 3 or 4 lb. per day. Hunting-horses, and all riding-horses which are kept at hard work, should be liberally fed—horses over 15 hands, perhaps from 15 to 16 lb. of bruised oats per day, with 10 or 12 lb. of chaffed hay; the allowance

of oats for smaller horses being reduced by 2 or 3 lb. per day. A few pounds of carrots—not more than 3 lb. per day—may occasionally be given with advantage. For hunters, Dr Fleming recommends the substitution of 2 lb. of split beans for 2 lb. of the allowance of oats.

Army horses usually receive 10 lb. of oats per day with 12 lb. of hay, and—for litter—8 lb. of straw. When on severe duty, or in camp, the allowance of oats is increased to from 10 to 14 lb. per day. The hay is given uncut.

Quantity of Food.—It is considered that, as a rule, an average-sized draught-horse will require about 29 lb. of food per day. Much less than that, even although it should be highly nutritious, will not be sufficient to maintain the animal in a healthy and vigorous condition. Reynolds states that such a horse, when moderately worked and well housed, will consume from 29 to 34 lb. per day, of which the hay and straw should constitute about two-fifths.

Bulk of Food.—It is undesirable, in ordinary cases, to attempt to feed horses mainly upon highly concentrated food. In order to enable the digestive organs to properly perform their functions, a certain considerable degree of bulk in the food is necessary. When horses are hard-worked, the morning and mid-day meals may advantageously be small in bulk—a feed of oats can be speedily eaten, and does not interfere with the breathing organs as does a bulky feed of hay or straw. But at night, in these cases, bulky food should be given.

Frequency of Feeding.—Horses should be fed at least three times a-day—before 6 in the morning, about mid-day (as soon as brought in from work), and in the evening. The exact hours will depend upon local circumstances as to the work being carried out. But it is very important that precise feeding hours should be arranged, and that these should be rigidly adhered to. Punctuality in feeding is a most important consideration.

Long fasts are detrimental to horses. The standard hours of farm-work seldom permit of more than three meals per day; but it would be far better for the horses if they could be fed four times a-day, at intervals of not more than four hours. Let the evening meal be the largest and bulkiest, as the horses have then plenty of time for thorough mastication. Long fasts and rapid and heavy feeding often give rise to disorder of the digestive organs, and care should be taken to give the animals ample time to consume their food in comfort. Improper mastication, often caused by too hurried feeding, renders the process of digestion more difficult. At long spells of work, a feed of grain, even if it should be very small, given in a nose-bag, will be found very beneficial. Do not give more food of any kind at a time than the animal is likely to consume, as if any were left it would become stale and unpalatable, and probably be wasted.

Care of Horses in Summer.

The care of horses in summer causes little trouble or anxiety.

Pasturing Work-horses.—On many farms, especially in Scotland, the rule is to graze horses. As soon as the warm weather of summer has fully set in, the horses lie out in a pasture field overnight. Between the yokings they either get cut grass in the stable or are put on pasture, the latter plan saving the trouble of cutting grass. Work-horses are liable to suffer much from chilly nights, cold often laying the foundation of diseases—such as rheumatism, costiveness, stiffness of the limbs. The aftermath is good pasture in the interval of work at noon, and the second cutting of clover may last for suppers until the time to betake to the stable altogether.

Soiling Horses.—Many farmers disapprove of pasturing farm-horses, and support them at the steading upon forage. Where there are hammels or courts which could be easily divided, we would adopt this plan at once, but we are doubtful of its advantage in a stable. The heat of a stable in summer—and the doors cannot be left open—with the evaporation of the increased issue of urine due to the green food, cannot fail to vitiate the air. The cattle-courts are more open; and if they can be divided so that each pair of horses may have a compartment to themselves, they will thrive admirably here.

In the tillage districts of England this system of summering horses in the cattle-courts is extensively pursued. Many

farmers, indeed, maintain that there is no better or cheaper method of keeping draught-horses in summer than in the courts, fed with green vetches or other similar succulent food, and dry hay, with perhaps a little bruised oats. Very often the grain is omitted.

Still it is a good plan to give the horses a week or two of the fresh air in an open pasture field.

Pasturing Young Horses.—Young horses are put to pasture during the day as soon as they can obtain a bite. They should be brought at night into their hammels until the grass has passed through them; after which they should lie out all night in a field which offers them the protection of a shed or other shelter. Work-horses do not care for a shed on pasture, being too much occupied with eating during night to mind it. In rainy weather young horses should be kept in the hammel on cut grass, and not exposed to rain in the field overnight.

The farmer's saddle-horse should usually have grass in summer, as it is the most wholesome food it can have. But it is more convenient to give it cut grass in a court or hammel than to send it to pasture, where it may be difficult to catch when wanted.

Peculiarities of the Horse in Grazing.—It is surprising with what constancy a work-horse will eat at pasture. His stomach being small in proportion to the bulk of his body, the food requires to be well masticated before it is swallowed; and as long as that process is proceeded with while the grass is cropped, no large quantity can pass into the stomach at a time.

The horse, like all herbivorous animals, grazes with a progressive motion onwards, and smells the grass before he crops it. His mobile lips seize and gather the stems and leaves of the grass, which the incisors in both jaws bite through with the assistance of a lateral twitch of the head. When grass is rank, he crops the upper part first; and when short, bites very close to the ground. Horses should not graze amongst sheep, as both bite close to the ground; and work-horses often injure sheep that come in their way, either by a sly kick or by seizing the wool with their teeth.

It is proverbial that horses do not graze well upon many of the very best bullock pastures. Horses often do better on rough pasture than on land which has been altered in its herbage by thorough drainage.

Horses Injured by Green Food.—Care must be exercised in beginning horses with green food every year. If allowed to gorge themselves too freely at the outset, serious illness may follow. Begin them sparingly with it, and if it should be wet or very succulent at any time during the season, it will be all the better to be accompanied or mixed with a little dry food such as hay.

Littering Horses.

Straw as Litter.—Straw is the most largely used, and is the best of all kinds of litter for horses. Wheat-straw, being stronger and tougher, is preferable to oat, or any other variety of straw, but in many parts of the country wheat-straw is not available. The stall should be thoroughly cleared out every morning, the wetter portions of the litter sent to the manure-pit with the dung; and the drier parts, which may be fit to be used for another night's bedding, retained in some convenient corner, or if the weather is dry, spread out near the stable, and taken in again in the evening.

Litter which has been used should never, as is sometimes the case, be stored beneath or in front of the manger, as the ammonia is apt to rise and injure the eyes of the horse, as well as taint its food.

From 8 to 14 lb. of straw is generally used as litter for each horse per day. With care, 8 to 10 lb. should be quite sufficient.

Peat-moss Litter.—The best substitute for straw as litter for horses yet introduced is "peat-moss litter"—peat-moss which has been broken and compressed by machinery till most of the moisture has passed away, leaving soft, spongy, fibry-looking vegetable matter. It makes cheap and comfortable bedding, absorbs and conserves the urine, and is a powerful deodoriser, keeping the stalls sweet and wholesome. It has a highly beneficial effect upon the feet of horses, keeping them cool, and encouraging the growth of strong tough hoofs. For animals with tender feet it is most beneficial. It is also valuable as manure, and its use

should be commended on account of the saving of straw thus effected.

Peat-moss litter is now a regular article of commerce.

Other Varieties of Litter. — Many other substances are used as substitutes for straw in littering horses, such as sawdust, fine sand, spent tan, leaves of trees, and ferns. Sawdust is often used, but by itself it does not make comfortable or desirable litter. As a padding beneath a thin layer of straw it is very useful, comfortable, and economical, and may be resorted to where peat-moss litter cannot be procured at reasonable cost. Sawdust should be spread in a layer 2 or 3 inches deep, and raked daily. At least once every week the stall should be thoroughly cleaned out, and an entirely fresh layer of sawdust laid down. Where ferns are plentiful, they may be cut and stored for use as litter in winter. Spent tan, about 6 inches deep, makes durable and useful litter. If the surface is carefully cleaned of the dung every morning, and the tan raked by an iron garden-rake, one layer will last over a month. Scatter a little gypsum over it now and again.

General Hints.

Exercise.—Horses that are not regularly at work should be exercised punctually every day, say, just after breakfast. In very cold weather in winter towards mid-day may be preferable. Unless idle horses have plenty of exercise given to them methodically, they are liable to contract "grease" in the legs, and become soft, flabby, and unfitted for active work. Horses that are entirely idle should have two hours' daily exercise. It is specially important for young horses to have plenty of exercise.

Rest.—Farmers are often not so careful as they ought to be in providing quietness and comfort for hard-worked horses during hours of rest. In particular, during the two hours of mid-day rest horses should have as little disturbance as possible. As soon as they have been made comfortable in their stalls, and been fed, they should be left in perfect quietness. The stable-door should be shut, and no one let in to disturb the repose of the animals till their own attendants return to prepare for the work of the afternoon. Again, when the horses come in at night fatigued by a hard day's work, they should as soon as possible, after being fed and rubbed down, be left for quiet rest till supper-time.

Washing Horses' Legs. — Horses working on wet land are apt to have their legs so besmeared with mud that nothing but washing will clean them. In that case the legs should be washed at night, great care being taken to dry the legs thoroughly. Washing is itself undesirable, and should be resorted to only when absolutely necessary.

Cracked and greasy heels are often caused by imperfect drying after washing or after exposure to wet and mud. Referring to this point, Dr Fleming gives a few words of warning which are well worthy of careful attention. He says: "It must, however, be regarded as essential to proper management, that under no pretext is a horse to be left for the night until all his legs have been thoroughly dried. Nor is this precept very difficult of execution; a handful or two of light wood sawdust, rubbed for a few minutes well into the hair, will absorb all the moisture from the most hirsute legs, affording not only a sense of comfort to the animal, but preventing those undesirable consequences engendered by continued application of cold and wet to the extremities."[1]

Shoeing Horses. — Highly satisfactory methods of shoeing the various classes of horses are now pursued in almost all parts of the country. Skilled shoers are everywhere to be found, and farmers should be careful to see that the feet of their horses are well shod and kept in good condition.

Clipping and Singeing.—For horses which have rank coats of hair and have fast trotting work to do, clipping or singeing is found advantageous. This is seldom practised with farm-horses; and if they are well groomed there will be little need for any interference with the length of the coat. Clipping is most generally pursued with the ranker coats, and this is done speedily and efficiently by a clipper such as those (Clarke's) represented in fig. 741.

Shorter coats are singed, either oil or

[1] *The Practical Horse-Keeper*, 93.

gas being used in the singeing-lamp, the latter being preferable.

Injurious to Clip Legs of Horses.—But while this system of clipping or singeing has its advantages, there is one practice often resorted to which is entirely mischievous and should be strictly forbidden, and that is clipping the hair from the legs of draught-horses. In condemnation of this practice we cannot do better than quote the words of Dr Fleming, who regards it as "highly pernicious," and adds: "Hair is the natural protector of the cuticle, and is especially required to warm and shield the delicate skin of the heels; its removal from these situations is certain to induce a predisposition to *grease*, and other equally serious consequences. If the legs are muddy on return from labour, they should be dried as far as practicable, and the adherent clay subsequently removed

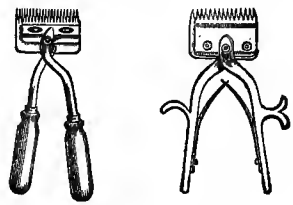


Fig. 741.—*Horse-clippers.*

with a hard brush. The application of the thinnest possible film of pure neat's-foot oil to the surface of the hair of the legs will prevent the adhesion of clay, but it should only be used when absolutely necessary. . . .

Protection to Skin from Wet.—"A predisposition to cracked heels is engendered by clipping the legs and pasterns in winter: this should never be done, if possible; but if necessary, then the skin should be protected from the action of wet and dirt by rubbing into it, before the horse leaves the stable, hard vaseline or zinc ointment. A very good protection against the action of icy cold water, or the salt slush which is so common on tramway lines in winter, is a mixture of one part of white-lead and three parts common oil, rubbed around the pasterns and the coronets by means of a brush."

Method in Stable Management.—Method and punctuality contribute as much to successful stable management as to success in business. Let the stable rules be arranged on a well-thought-out, workable plan, such as will, in the most effective manner possible, contribute to the comfort and usefulness of the horses. And when the rules are laid down, see that they are rigidly adhered to. Irregularity in the feeding and general treatment of horses is most detrimental to their wellbeing. Among horses let all things be done quietly, kindly, and in order. Horses appreciate kindly treatment, and will repay such behaviour by confiding obedience. Good horsemen and good horses get warmly attached to each other. There is more of the "social element" about the horse, the greatest of all our quadruped friends, than the casual observer would be inclined to give him credit for.

The Foaling Season.

The foaling season is an anxious time for the owners of brood mares. The risks in foaling are greater than the calving risks, for the bovine race is hardier than the equine. With moderate skill and timely attention, however, serious losses in foaling are not likely to be of frequent occurrence.

Insurance against Foaling Risks.—Several insurance companies provide special facilities for insurance against losses in foaling, and farmers are prudently taking advantage of this provision of safety. The cost of insurance is comparatively small, and the sense of security it affords to the farmer is very comforting.

Abortion in Mares.—Abortion in mares, as in other animals, is often difficult to account for. In the large majority of cases, however, it may be attributed to injury inflicted in one form or other. A fright, chasing, running away, hurried driving, a kick from another horse, over-exertion at work, being driven in too heavy a grubber or cultivator, ploughing hard beaten headlands, being bogged in soft land, a shake between the shafts of a heavily loaded cart or waggon, or being upset or cast in shafts, are amongst the more violent actions liable to cause abortion. But it may also be induced by serious illness, improper feeding, especially with forcing food, exposure to wet stormy weather,

eating poisonous plants, consuming frosted food, drinking an excess of cold water, &c.

When abortion does occur, the mare should be kept apart from other mares in foal until they have produced their young. And these other mares should not be allowed access to the spot where the unfortunate mare aborted.

Care of Brood Mares.—The greatest possible care should be exercised all through the period of pregnancy, alike in feeding and working the mare. She should be fed liberally but not excessively, for overfeeding may itself cause abortion. It is a well-known fact that overfed mares are liable to produce small foals, and the tendency to this is still greater when the overfed mare is an idle animal, kept perhaps solely for showing and breeding purposes.

Little need be said here in regard to the care of brood mares in and near the foaling season. The subject has already been fully dealt with in earlier parts of this volume in connection with the management of the leading breeds of pure-bred horses.

There is considerable difference of opinion and practice amongst farmers as to the working of mares up to foaling-time. Mares accustomed to steady farm-work may safely enough be kept at the lighter kinds of work up to within a few days, or at most a week, of the expected date of foaling. Carting, however, is dangerous, and should be avoided.

About ten days before the date upon which the foal is expected, the foaling compartment should be prepared. This should be free from draughts, comfortable in every way, and large enough to allow the mare to turn herself with ease at any part of it without incurring the risk of crushing the foal in so doing.

Watching Mares at Foaling.—It is very desirable that an eye should be kept on the mare night and day at foaling-time. Mares carry their foals from 330 to 360 days, eleven months being the time most generally "reckoned." They are by no means punctual, however, and very often a mare has to be watched for a week or ten days, occasionally even longer.

Symptoms of Foaling.—One of the surest signs of the approach of foaling is afforded by the udder. It of course becomes larger, and a waxy material appears like a bean at the tip of each teat. After this is present, in three cases out of four the mare will foal within twenty-four hours, and should not be left till the event has taken place.

Less definite indications of the completion of the period of pregnancy are the drooping of the belly, the enlargement and relaxation of the external organs of generation, and the flanks sinking inwards. The mare becomes dull and disinclined for exercise, while the movements of the foal may be seen to grow more distinct and active.

Assistance in Foaling.—Mares seldom need assistance in foaling. When aid is required, great skill and care must be exercised in rendering it. In cases which threaten to be protracted, or show any unusual and dangerous symptoms, the veterinary surgeon should at once be called in. Rarely, indeed, is a case of difficult foaling carried through successfully by any except an experienced and specially trained man in obstetrical work amongst farm animals.

Difficult Foaling.—If the mare has gone the full time of pregnancy, any exceptional difficulty in foaling is more than likely to arise from the foal lying in an abnormal position. The head and fore-feet should come first, the head resting upon the two fore-legs, just as in the case of a calf. If the labour pains are protracted without any apparent or sufficient progress, the hand and arm should be well lubricated with soft warm water and an antiseptic soap, and gently inserted to discover the position of the foal. If it is in its natural position as indicated, a little time will likely complete the process. If the foal is not yet in the passage, give the mare more time, and if necessary make another examination. If the foal is not presenting itself in the usual position mentioned, it may be necessary to adjust it, or at any rate to make some alteration in its position before birth can take place.

But this delicate work requires so much skill that, as already stated, it cannot be safely intrusted to any but a well-trained veterinary surgeon. If at all possible, have the veterinary surgeon at hand in

such cases. If this is impossible, obtain the advice and assistance of the most experienced person within reach. Do not be too hurried in assisting the mare. Watch carefully, and assist nature when assistance seems likely to be useful. The mare needs more skilful and more careful operating than the cow in difficult parturition, and constant attention may be required to prevent her injuring herself should she become violent.

Such a case as this, however, is quite exceptional. As a rule, all that need be provided for the mare is a comfortable and cleanly compartment, with just a little less than the usual amount of food given to her when at work. The rest will, in most cases, be accomplished by nature.

Reviving an Exhausted Mare.—If the mare should seem to be weak or exhausted she may be revived by a drink of milk-warm oatmeal gruel, with the addition of a quart bottle of good ale.

Support to Mare's Belly.—Brood mares which have produced several foals are liable, when well up in years, to show a large extension of belly. For the sake of appearance as well as comfort to the mare, it would be well in extreme cases to support the belly for a time after foaling with wide, strong bandages wrapped several times round the body.

Mare's Udder.—Inflammation sometimes occurs in the udder of a mare being sucked. The udder is found to be hard and hot to the touch, and evidently painful to the mare. Foment the udder with warm bran-water, rub gently, and draw away a little milk at frequent intervals. It may be necessary to remove the foal for a few days and give the mare a dose of physic. Do not give medicine unless the foal is taken away from the mare for the time. A change of diet and low feeding for a few days may give relief. In a bad case, lose no time in calling in the veterinary surgeon.

After Foaling.—When it is seen that the foaling has been completed successfully, and the mare and foal are on their feet, a drink of warm gruel, made of oatmeal and water, or oatmeal, bran, and water, with a little salt in it, should be given to the mare, some sweet hay being placed in the rack. The two should then be left alone for a little time, but carefully watched. As a rule, they speedily become accustomed to each other's society, and only in exceptional cases is any further interference required, either on behalf of the foal or the mare.

Cleansing.—In ordinary circumstances the "after-birth" will come away of its own accord very shortly after delivery. If it has not done so within at most ten or twelve hours, it will very likely have to be removed by the hand. This must be done gently and carefully; and if the after-birth has begun to decompose, the passage and uterus should be cleansed and disinfected by plentiful injections of some mild antiseptic fluid.

After-straining.—If the mare should continue to strain heavily for some time after birth, it may be assumed that all is not well with her, and that the advice of the veterinary surgeon would be useful.

Attention to the Foal.—The foal needs attention the moment it is born. First see that it has broken through and freed itself from the enveloping membranes, so that it has freedom to breathe. Then examine the umbilical cord, or navel-string, and see that it has been severed, and that there is no serious bleeding. The navel-string may be snapped in the act of foaling, but it is much safer to tie it. The attendant should tie a piece of thoroughly clean cord that has been soaked in an antiseptic solution around the navel-string about three-quarters of an inch from the skin; tie again an inch and a half farther down, and divide between with a clean knife. The stump of the cord should then be dressed with a strong solution of carbolised glycerine up to and over the edge of the skin.

Reviving Weak Foals.—It occasionally happens that a foal, although still living, is to all appearance dead when born. In this case, efforts should at once be made to induce respiration. A moment's delay may result in the extinction of the vital spark, which, with prompt action, might be fanned into active life.

Weakly foals will be all the better of a little extra attention at the outset, in the way of rubbing and drying with a woollen cloth. The limbs as well as the

body should be well rubbed. It helps to promote circulation and give strength to the young creature.

Rearing Foals.

The feeding and general treatment of foals in pure-bred studs have been fully dealt with earlier in this volume, and therefore little detailed information will be required here.

Foals are not so robust as calves, and are more subject to injury from cold and wet. In the great majority of cases, the foal is reared almost entirely on its mother's milk for a period ranging from four to six months.

Troublesome Mares. — Unless exceptional circumstances have arisen—unless from some cause or other the mare becomes an inefficient or unkindly nurse —it will rarely happen that the mother and offspring require any special aid or interference until weaning-time arrives.

Occasionally it happens that a mare requires coaxing to admit the youngster to the udder, but with patience, tact, and kindliness success is generally attained. If sterner measures should be necessary, it is a good plan to put a net-muzzle on the mare's mouth and allow her to reach the foal with her mouth, but in a position that she cannot get at it with her feet. This should only be tried when the mare and foal can have sufficient attention. A bridle with blinkers may be required, and even a fore-foot held up, but do not use a twitch or strike the mare. Sometimes it is found that the bringing of a strange horse within sight of the mare a few days after foaling induces her to abandon her indifference and take the foal under her protection.

Beginning the Foal to Suck.—The foal will often be very awkward in its first efforts to suck. Do not attempt to assist or direct it except towards the proper quarter. Keep the mare quiet, and let the youngster feel its way itself. The instincts of nature will be its best teacher, and it will soon learn how to proceed. The mare's udder may be hard, and the teats dry. If so, rub the udder with the hand, and draw away a little milk, leaving the teats moist, so as to lead on the foal in its first attempt to suck.

Nursing Motherless Foals.—When a mare dies and leaves a living foal, or when a mare is unable to rear twin foals, or even to rear one, the best course for the sake of the foal is undoubtedly to procure a nurse-mother. No system of hand-rearing is quite equal to the mare's udder; and especially in the case of an exceptionally valuable foal an effort should certainly be made to procure a nurse-mother. This, however, is usually difficult to obtain, and, as a rule, foals that cannot be suckled by their own mothers have to be reared by the hand.

Rearing Foals by Hand.—For the young foal cow's milk is the next best food to the mare's milk. If the foal is newly born, the milk must at the outset be poured gently into its mouth out of an old teapot or kettle. By the time the foal is a week or ten days old it may be taught to drink the milk out of a pail, just as the hand-fed calf drinks milk. Give the foal your fingers to suck, and gently lead its head into the pail until it draws up milk between the fingers. In this manner it will readily learn to drink of its own accord when the pail is placed before it.

Cow's Milk for Foals.—Cow's milk, as we have said, is the best food on which to rear a foal for which mare's milk cannot be obtained. For some time at the outset, at any rate, the milk should be new and warm as it comes from the cow. Many experienced breeders think it desirable to dilute the milk with warm water and a little sugar. The foal should get little at a time, and be fed four or five times a-day. It may not be convenient to milk a cow so often as five times a-day, and therefore, at least for two of the meals to the foal, the cow's milk may have to be kept for two or three hours. In this case the milk should be heated to about the temperature of new milk by the admixture of a little hot water in which a very little sugar has been dissolved. When it is desired to give the milk undiluted, the best way of heating it is to insert the tin vessel holding it into another vessel containing hot water.

Bean-milk and Cow's Milk for Foals.—It sometimes happens that foals do not thrive satisfactorily on cow's milk alone. In this case the substitution of bean-milk for perhaps about one-half of

the cow's milk may be tried. The bean-milk is prepared by boiling the beans almost to a pulp, removing the shells, and pressing the pulp through a fine hair-sieve. The result is a thick creamy fluid or paste. Sprinkle a pinch of salt over it, add the cow's milk entire or diluted, and the compound is ready for the foal. This system of feeding is highly spoken of by breeders of great experience.

Linseed, Bean-meal, and Milk for Foals.—Another liquid mixture used successfully in rearing foals consists of skimmed milk, linseed, and bean-meal. One formula for preparing the daily food of a foal from these substances is as follows: 12 pints sweet skimmed milk, 1 quart of linseed, which has been previously boiled for three or four hours, and 3 lb. of fine bean-meal added in a dry state. In some cases where the mares are hard-worked on the farm, the foals are weaned when only a few weeks old, and reared by the hand in some way similar to the above.

Health of the Foal.—During the nursing period the health of the foal must be watched carefully, so that its progress may not be interrupted by any derangement of the system that might be avoided or remedied. Young foals are liable to suffer from constipation, especially if they have not been able to suck the *first milk* from the mare's udder. The first milk is by nature provided with a moderate purgative tendency which is very beneficial to the offspring; but if the slightest symptoms of constipation appear in the foal it should at once receive a light dose of castor-oil.

Diarrhœa must also be carefully guarded against. Fresh air, exercise, protection from inclement weather, and good sound food to the mare, are the surest preventives.

Housing Mares and Foals. — The best treatment is to remove the cause, and if that cannot be done, call in a veterinary surgeon. Unless the weather is dry and genial, it will be prudent to keep the mare and foal under cover for a week or more. At the end of that time they will both be able to go out to the field for a short time. Every change should be gradual, whether it be a change from one kind of food to another, from a cosy box to an open field, or from idleness to work.

Working Nurse-mares. — Draught mares are often returned to work in a week or ten days after foaling. If circumstances permit, it would be better to delay till the beginning of the third week—better for the mare and the foal too. In any case, the work for a time should be light, and for several weeks the mare should not be kept longer from the foal than two or three hours on end. With good feeding the mare will be able for two yokings, of three hours' duration each, at light work, in six or eight weeks after foaling. As long as the foal is depending mainly upon the mare for its sustenance, it will be better, in a pressure of work, to take three yokings of three hours each daily from the mare, with intervals of not less than an hour, than to keep her longer in work at one time. Two short yokings daily, however, are as much as any nursing-mare should have to accomplish.

Some recommend that the foal should accompany the mare to the work, and be allowed to suck her at frequent intervals. It is safer to keep the foal in more comfortable quarters, and bring the mare to it at intervals of from two and a half to three hours, according to the stage in the nursing period.

It is injudicious, dangerous indeed to both mare and foal, to keep the mare away from the foal until her udder is much engorged and distended. Inflammation may arise in the udder, and unless it be at once checked, the life of the mare may be endangered. Then it will be risky for the foal to allow it to suck the milk from the inflamed udder. If there is any reason to suspect that inflammation has begun, a portion of the milk should be drawn away by the hand and the udder bathed with cold water before the foal is admitted.

Nursing-mares should never on any account be overheated at work.

Brood-mares while nursing their young should be liberally fed, especially so when working hard at the same time.

Weaning Foals.

The weaning-time is a critical period in the existence of a young horse. It is usually the first great trial of its life,

and if the animal is not properly cared for at the time, its progress may be seriously impaired. In ordinary circumstances foals are weaned when they are from four to six months old.

As already indicated, the foal should be trained to eat other food some time before weaning. As the time for weaning approaches, the intervals during which the foal is withdrawn from the mare will be lengthened, and the extra food increased. And if the foal takes kindly to its other food, this process need not be long continued.

Whether the weaning process is to be short or protracted will depend mainly upon (1) the manner in which the foal takes to and thrives upon the other food; (2) the condition of the mare's udder; and (3) the necessities of the time as to the working of the mare. If the foal is weakly, and does not seem to thrive satisfactorily upon the other food, it may be well to continue a little of its mother's milk for some time: better submit to some inconvenience in this way than spoil a good foal. Then the mare may have such an abundant flow of milk that the sudden withdrawal of the food would be undesirable for her sake. On the other hand, the pressure of work may require that the weaning shall be completed as quickly as possible. Thus, in weaning, there is need for experience and careful consideration.

Feeding Foals at Weaning-time.—As to feeding, the foal should be well attended to at weaning-time. Feed it liberally but not to excess, taking care to keep its bowels and general health in as good order as possible. Bruised oats, bran, and beans make a capital mash for foals; and some add boiled linseed.

Attention to the Mare at Weaning-time.—At weaning-time the feeding of the mare also needs careful attention, so that the flow of milk may be stopped. Hard work and spare feeding will diminish the secretion of milk. Let the food be dry and lessened somewhat in quantity. Even the allowance of water may be slightly restricted. Draw some milk from the udder once or twice a-day, or oftener if it becomes very full, but do not empty it at any time. If the secretion of milk is not diminishing satisfactorily, it may be well to give a light dose of physic. This is sometimes necessary with mares maintained solely for breeding, but rarely with mares kept hard at work.

In the event of a mare having to be dried soon after foaling, by the death of the foal or other cause, the flow of milk will usually be stopped by drawing away a little milk by the hand once or twice daily for a few days, and by giving the mare some purgative medicine, a short allowance of dry food and little water, and plenty of work or other exercise.

The Mating Season.

In regard to the mating of horses little need be said here. The information already given in this volume on this subject in reference to pure-bred stock is equally applicable to the breeding of ordinary farm-horses.

The latter end of spring and early summer is the *mating season* for horses. Both mares and stallions are in the best form for breeding when in robust health, in good natural condition—just such condition as should be shown by hard-worked well-cared-for horses. Overfeeding should be avoided; it is as injurious as insufficient feeding.

A mare will usually come into *season* about nine or ten days after foaling, but occasionally not in less than twice that period. It is generally quite apparent when a mare desires to receive a stallion; but if there is any doubt, the point may easily be settled by *trying* her with the stallion.

It is advisable to serve the mare in the first heat of the season. As a rule, with healthy animals one service will be sufficient. About twenty days after the first service the mare should again be shown to the stallion, and if the usual symptoms of desire are not then exhibited by her, it may be assumed that she is pregnant. Still she may "come round" again in about three weeks, and the attendant should watch carefully for the symptoms. Some breeders think it desirable to have the mare served twice at one time, with an interval of ten to twenty-four hours; but this is not the rule.

Number of Mares to one Stallion.—The number of mares allotted to one stallion in a season varies considerably with circumstances, such as the age, con-

dition, and value of the horse. An adult horse in robust active condition may have from 60 to 70 mares. The number often exceeds 80, but it is highly imprudent to overdo a stallion, and it may incur the risk of many *blanks* amongst his mares.

Nomenclature of Horses.

The names given to the horse are these: the new-born is called a *foal;* the male being a *colt foal*, the female a *filly foal.* After being weaned, foals are called simply *colt* or *filly*, according to the sex. The colt when broken into work becomes a *horse*, and remains so all his life; and the filly is changed into *mare.* When the colt is not castrated he is an *entire colt*, which he retains until he is fully grown or serves mares, when he is a *stallion* or *entire horse;* when castrated he is a *gelding*, and it is in this state that he is a draught-horse. A mare, when served, is said to be *covered by* or *stinted to* a particular stallion; and after she has borne a foal she is a *brood mare* until she ceases to bear, when she is a *barren mare* or *eill mare;* and when dry of milk she is *yeld.* A mare, while with young, is *in foal.*

Names Suitable for Farm-Horses.

Names for horses should be *short and emphatic*, not exceeding two syllables, for long words are difficult to pronounce when quick action is required. For geldings, Tom, Brisk, Jolly, Tinker, Dragon, Dobbin, Mason, Farmer, Captain; for mares, Peg, Rose, Jess, Molly, Beauty, Mettle, Lily, seem good names. For stallions, they should be important, as Lofty, Matchem, Diamond, Blaze, Samson, Champion, Bold Briton, &c.

The language spoken to horses by their drivers is referred to in vol. i. p. 381.

MANAGEMENT OF COWS AND CALVES.

In the notes on the breeds of pure-bred cattle in this volume a good deal of information is given regarding the feeding and general management of cows and the rearing of calves. What little need be added here will apply mainly to ordinary commercial cattle, though, as a rule, it is only in small details that the treatment of cows and calves in mixed-bred stocks differs from that in pure-bred herds.

CALVING SEASON.

In exceptional cases, mostly in milk-selling herds, calving takes place all the year round. In the vast majority of stocks, however, the great bulk of the calving occurs in the months of January, February, March, and April, the spring months being most in favour in all excepting pedigree herds.

The risks of the calving season are considerable, and at this time breeding stocks require the most careful daily attention from their owners and attendants.

Symptoms of Pregnancy. — Cows may be ascertained to be in calf between the fifth and sixth months of their gestation. The calf quickens at between four and five months, and it may be felt by thrusting the half-closed hand, in which the point of the thumb projects over the curved index finger, against the right flank of the cow, when the calf should be felt as a distinct hard lump. All the flank should be explored, and strong, deep, but not violent, punches given before failure to detect it is acknowledged. Or when a pailful of *cold* water is drunk by the cow, the calf moves, when a convulsive sort of motion may be observed in the flank, by looking at it from behind, and if the open hand is then laid upon the space between the flank and udder, this motion may be distinctly felt. It is not in every case that the calf can be felt at so early a period of its existence, for lying then in its natural position in the interior of the womb, it may not be felt at all; and when it lies near the left side of the cow, it is not so easily felt as on the opposite one. Therefore, although the calf may

not be *felt* at that early stage, it is no proof that the cow is not in calf.

When a resinous-looking substance can be drawn from the teats by stripping them firmly, many consider it a sure sign of pregnancy. After five or six months, the flank in the right side fills up, and the general enlargement of the under part of the abdomen affords considerable evidence of pregnancy.

But there is seldom any necessity for thus trying whether a cow is in calf, for if she has not sought the bull for some months, it is almost certain to be because she is pregnant.

Reckoning Time of Calving.—The exact time of a cow's calving should be known by the cattle-man as well as by the farmer himself, for the time when she was served by the bull should be registered.

Gestation.—A cow is reckoned to go just over 9 months with calf, although the calving is not certain to a day. The late Earl Spencer found from records of the calving of 764 cows that 314 cows calved before the 284th day, and 310 calved after the 285th; so he considered that the probable period of gestation ought to be regarded as 284 or 285 days, and not 270, as generally believed. In those observations the shortest period of gestation when a live calf was produced was 220 days, and the longest 313.

Prolapse of the Vagina.—Cows are most liable to this complaint when near the period of calving, about the eighth and ninth months, and, from whatever cause it may originate, the position of the cow, as she lies in her stall, should be amended by raising her hind quarters as high as the fore by means of the litter. No great danger need be apprehended from the prolapse, but it is better to use means to prevent its recurrence than to incur bad consequences by indifference or neglect.

Feeding In-calf Cows.—Much more care should be bestowed in administering food to cows near the time of their reckoning than is generally done. The care should be proportioned to the state of the animal's condition. When in high condition, there is risk of inflammatory action at the time of parturition. It is therefore the farmer's interest to check every tendency to obesity in time. Moderate quantities of turnips suit well, so also do barley mashes and small quantities of oil-cake, the laxative tendency of the oil-cake being a special advantage for in-calf cows.

Critical Period in Pregnancy.—The eighth and ninth months constitute the most critical period of a cow in calf. The bulk and weight of the fœtus cause disagreeable sensations to the cow, and frequently produce feverish symptoms, the consequence of which is costiveness. The treatment is laxative medicine and emollient drinks, such as a dose of 1 lb. of Epsom salts with some cordial admixture of ginger and caraway-seed and treacle, in a quart each of warm gruel and sound ale.

Calving.

Symptoms of Calving. — Symptoms of calving indicate themselves in the cow about fourteen days before the time of reckoning. The loose skinny space between the vagina and udder becomes florid; the vulva becomes loose and flabby; the udder becomes larger, firmer, hotter to the feel, and more tender-looking; the milk-veins along the lower part of the abdomen become larger, and the coupling on each side of the rump-bones looser; and when the couplings feel as if a separation had taken place of the parts there, the cow should be watched day and night, for at any hour afterwards the pains of calving may come upon her. In some cases these premonitory symptoms succeed each other rapidly, in others they follow slowly. With heifers in first calf these symptoms are often slow.

Attendance in Calving. — Different practices exist in attending on cows at calving. In most cases the cattle-man attends on the occasion, assisted sometimes by the shepherd, and other men if required, but in some districts in Scotland the calving is left to women to manage. The large and valuable breeds of cows almost always receive assistance in calving. The cows of the smaller varieties frequently calve without assistance.

In cases of difficult calving a veterinary surgeon should be summoned.

Preparation for Calving. — A few preparatory requisites should be at hand when a cow is about to calve. Flat *soft* ropes should be provided for the purpose

of attaching to the calf. The cattleman should have the calf's crib well littered, and pare the nails of his hands close, in case he should have occasion to introduce his arm into the cow to adjust the calf; and he should have some antiseptic oil or ointment or antiseptic soap and soft warm water with which to lubricate his hands and arms, although the glairy discharge from the vagina will usually be sufficient for this purpose. It may be necessary to have bundles of straw to put under the cow to elevate her hind-quarters, and even to have block and tackle to hoist her up in order to adjust the calf in the womb. These last articles should be ready at hand if wanted. Straw should be spread thickly on the floor of the byre, to place the new-dropped calf upon. All being prepared, and the byre-door closed for quietness, the cow should be carefully watched.

The Calf.—On the extrusion of the calf, it should be laid on its side upon the clean straw on the floor. The calf should never be allowed to fall with its full weight on the floor. The breathing is assisted if the viscid fluid is removed by the hand from the mouth and nostrils. The calf is then carried by two men, suspended by the legs, with the back downwards, and the head held up between the fore-legs, to its comfortably littered crib.

Navel-string.—The state of the navel-string is the first thing that should be examined in a new-dropped calf, that no blood be dropping from it, and that it is not in too raw a state. The bleeding can be stayed by a ligature on the string, but not close to the belly. Inattention to the navel-string may overlook the cause of the navel-ill; and, insignificant as this complaint is usually regarded, it carries off more calves than most breeders are aware of. The navel-string should be dressed two or three times daily until dried up with a dressing consisting of one part of pure carbolic-oil to twenty parts of olive-oil.

Inflammation of the navel is often caused by one calf sucking another.

Reviving Calves.—Some calves, though extracted with apparent ease, appear as if dead when laid upon the straw, but they may only be in a condition of suspended animation. A powerful attendant should seize the calf by the hind-legs above the hock, swing it vertically clear of the ground, while another strips all viscid material from its mouth and nostrils. It should then be laid flat on its side at all its length, with head, neck, and legs extended. An intelligent operator should then use artificial respiration in the same way it is used in the apparently drowned, by elevating and depressing a fore-leg. The leg should be pulled upwards and forwards until it is evidently pulling at the chest-wall by its attachments, then pressed gently downwards and backwards over the lower part of the chest, the weight of the operator's arm going with it. This should be repeated from six to ten times for less than half a minute. It should then be lifted vertically by the hind-legs again, its mouth and nose stripped as rapidly as possible, and laid on its other side a little roughly, and the process repeated with the other fore-leg. It should be turned this way after every eight or ten movements of the leg, vertically over its long axis, not horizontally over its back, its mouth and nostrils kept clear, and assistants applying friction to the skin and drying it at the same time with handfuls of hay or straw. The first sign of life may be a slight cough, after which care should be taken that the movements of the operator should harmonise with the efforts of the animal at natural respiration. Success has resulted by the use of this method after fifteen and even twenty minutes' steady persistent work.

Extracting a Dead Calf.—When the symptoms of calving have continued for a time, and there is no appearance of a presentation, the operator should introduce his arm to ascertain the cause, and the probability will be that the calf has been dead in the womb some time. A dead calf is easily recognised by the hand of an experienced cowman. It should be extracted in the easiest manner; but should the body be in a state of decay, it may not bear being pulled out whole, but may require to be taken away piecemeal.

Mistaken Idea.—A notion exists in some parts that a cow, when seized with the pains of labour, should be made to

move about, and not allowed to lie still, although inclined to be quiet. As a rule, she should not be interfered with.

Refreshing the Cow.—When a cow seems exhausted in a protracted case of calving, she should be supported with a warm drink of gruel, containing a bottle of sound ale. Should she be too sick to drink, it should be given her with the drinking-horn.

After the byre has been cleansed of the impurities of calving, and fresh litter strewed, the cow naturally feels thirsty after the exertion, and should receive a warm drink. There is nothing better than warm water, with a few handfuls of oatmeal stirred in it for a time, and seasoned with a small handful of salt. This she will drink up greedily. A pailful is enough at a time, and it may be renewed when she indicates a desire for more. This drink should be given to her for two or three days after calving in lieu of cold water, and mashes of boiled barley and gruel in lieu of cold turnips. At this critical period oil-cake is specially suitable, as it acts as an excellent laxative and febrifuge. Nothing should be given at this time of an astringent nature. The food should rather have a laxative tendency.

Immediate Milking.—It used to be considered desirable to milk the newly calved cow dry as soon as possible after calving. This is most unnatural. Her own calf would not take all her milk for days, and it is now recognised that milking dry soon after calving tends to induce milk fever. A little milk should be drawn from each quarter, but only sufficient to relieve the tension, and although this is done several times a-day the udder of a good milker should not be emptied for some days after calving.

Licking and Rubbing Calves beneficial.—Many skilled breeders systematically let the newly dropped calf be licked by the cow. There is more in this apparently small matter than is generally supposed. "The bloomy appearance of suckled calves is partly due to this motherly attention; and the licking along the calf's spine, which the cow, with her rasp of a tongue, gives her calf immediately after birth, has evidently an important meaning. All careful managers, when the calves are not reared by the cow, take care to imitate this process, rubbing well over the spine with a wisp of straw. This not only dries the calf and prevents its taking cold, but evidently strengthens it; and the calf, if a healthy one, responds to the rubbing by vigorous efforts, soon successful, to gain its feet."[1] It is, moreover, held by experienced breeders that the licking of the calf has a beneficial effect on the cow, and in the case of breeds liable to milk-fever this is especially so. It is good practice in such cases to leave the calf beside its mother for at least two days.

Bulling.

Coming in "Season."—A cow will desire the bull in four or five weeks after calving. The symptoms of a cow being in season need not be described.

Too Early Bulling Unwise.—There is good reason to believe that many cases of cows not holding in calf with the first serving after calving arises from the want of consideration on the part of breeders as to whether the cow is in that recovered state from the effects of calving which may be expected to afford a reasonable hope that she will conceive. The state of the body, as well as the length of time, should be taken into consideration in determining whether or not the cow should receive the bull when she first comes into "season."

Fig. 742.
Bullock-holder.
a Joint.
b Knobbed points, meeting.
c Screw-nut.
e Ring for rein-rope.

Leading Cows. — A cow is generally easily led to the bull by a halter round the head. If she is known to have a fractious temper, it is better to put a holder in her nose than to allow her to run on the road and have to stop or turn her every short distance. A simple form of holder is shown in fig. 742.

[1] *Jour. Royal Agric. Soc. Eng.*, sec. ser., xvi. 428.

ABORTION.

It is now recognised that there are at least two forms of abortion. The one, known as *Sporadic Abortion*, arises from many different causes, including accidents; the other, known as *Contagious* or *Epizootic Abortion*, is caused by a specific living organism. Heavy losses are often sustained by stock-owners from abortion, especially in herds of pure-bred cattle. Ewes abort frequently and mares occasionally.

SPORADIC ABORTION.

Causes.—Most frequently the direct causes of sporadic abortion are violent exercise, frights, bruises, careless attendance, diseased bulls, unwholesome food, impure water, and hay affected with ergot.

Fig. 743.—*Head of timothy with numerous ergots.*

Ergot causing Abortion.—As to the part which ergot has played in causing abortion there is difference of opinion. Ergot is a fungus which attacks the ear or panicle of grasses and cereals, rye particularly, and is recognised as a black spur, seen in fig. 743. Farmers should certainly regard ergot as a dangerous enemy, and should burn any portions of hay in which it is seen to exist to any considerable extent.

Prevention.—Immediately a cow shows symptoms of aborting, she should be separated from her companions and watched carefully. She should be kept perfectly quiet, and should get laxative food such as oil-cake and mashes, and if there is straining, frequent doses of opium, belladonna, or anti-spasmodics.

After abortion cows must be carefully attended, in order to get them back into a healthy natural condition, and to prevent abortion spreading. In cases of slow cleansing it may be well to give a dose of laxative medicine, such as 1 lb. of Epsom salts, 1 oz. powdered ginger, and 1 oz. caraway seeds.

Preventing Recurrence of Abortion.—There is great risk of recurrence of abortion amongst cows that have once aborted, and, as a rule, the wisest course is to fatten off aborted cows. When abortion occurs the byre should be thoroughly cleaned and disinfected, and every possible precaution taken to get the animals and premises into a clean healthy condition.

EPIZOOTIC ABORTION.

For the following notes we are indebted to Principal Dewar, Edinburgh: Early in the closing quarter of the twentieth century acute observers began to think that a form of abortion was not uncommon which manifested contagious properties. It was not till 1896, however, that Professor Bang of Copenhagen published his article on "Infectious Abortion," showing that abortion in cows was caused by a micro-organism, and that he could communicate the disease to pregnant animals by cultures of that organism. For most of our subsequent knowledge of the subject obtained up till about 1908 we are indebted to Professor Bang.

Causes of Abortion.

The causal organism, isolated by Professor Bang, is a fine short bacillus, and is found in an almost pure state in a slimy poultaceous exudate met with in animals that have just aborted, as well as in pregnant animals affected with the disease, between the uterus and the placental membranes.

For years after the contagious nature of the disease was accepted it was generally believed that it was not communicated like other contagious diseases, but only through the vulva and genital canal,—that it was mostly communicated in the byre owing to the discharges from affected animals passing into the gutter, and that each cow infected herself, and it might be her neighbour, by means of her tail, which became soiled with the contaminated fluids in the gutter. It

has now been proved, however, that animals may contract the disease by the injestion of food or water soiled with these virulent discharges, and it is very probable that the virus frequently gains access to the system in this way.

It has not yet been proved that the disease can be communicated by inhalation, by means of the respiratory organs, although the possibility of infection by this portal should not be lost sight of in dealing with the disease.

It is generally believed that a common method of infection is by means of the bull. Should a bull serve a cow that has aborted and that has not been properly treated for it, or any cow the genital passage of which contains abortion bacilli, unless he is carefully and thoroughly disinfected after service, there is a risk of him communicating the disease to every cow he serves for some time. That this means of infection has not been sooner and more generally recognised is due to the fact that the disease is of a very insidious nature, that the incubative period is very irregular and often very prolonged. A cow may contract the disease at the time of service from an infected bull, and may not abort until the seventh or eighth month of pregnancy. In such a case the real cause is likely to be overlooked and a less remote cause suspected.

Treatment.

It is seldom that contagious abortion is suspected in a herd until one or more cases occur, and by that time it is probable that a large number, in fact the great majority, of the cows and heifers may be affected, the bacillus proliferating in the uterus and setting up those chronic inflammatory changes which ultimately lead to abortion. Although we can hardly hope to prevent the accident in cases in which the disease is far advanced, still no one can be sure of the stage the disease has reached, and it is well to treat as affected all the pregnant animals that may have been exposed to the contagion.

For this purpose it has been recommended to wash or sponge the tail, anus, vulva, and perinæal region of each cow every morning with a reliable antiseptic wash. In addition to this a large syringeful of antiseptic wash, which should not be quite so strong as that used externally, should be injected into the vagina of each cow once a-week. The flooring of the byre should also be thoroughly scraped, cleaned, and disinfected every week.

Should some of the cows be giving milk, care should be taken not to use as antiseptic and disinfecting agents medicines which have strong penetrating odours, as the odour is apt to be communicated to the milk, and render it useless for human consumption.

Bräuer — on the Continent — recommended medicinal treatment with the view of getting at the organisms through the blood stream. He started with a subcutaneous injection of from half an ounce to an ounce of a 2 per cent solution of carbolic acid once a-fortnight, in addition to the external cleansing and washing out of the genital passage already mentioned, but he subsequently used double the quantity.

For a number of years the administration of carbolic acid by the mouth has been strongly recommended in this country for the purpose of destroying or hindering the proliferation of the organisms in the uterus. It is found that considerable quantities of the acid can be given in this way without causing any untoward symptoms. One well-known authority, writing in an agricultural paper, recommends half-ounce doses of a somewhat crude carbolic acid to be given to each cow three times a-week in bran-mashes. Some animals, he says, may be unwilling to eat mashes containing the acid.

As the purpose is to get at the organisms through the blood, it is necessary that the acid should be absorbed: it is therefore better to give it in smaller doses—quarter-ounce doses—and repeat oftener if necessary; and there is no doubt that a purer acid is less pungent, less irritating, much more readily taken by the cows, and quite as useful.

Preventive Treatment.

As the discharge from the uterus of aborting cows is the chief source of the contagion, it is necessary to use means to prevent its being spread in the byre or scattered in the field. Any cow, therefore, that shows the slightest symptom

of abortion should at once be removed from the others and put in a byre or building by herself. And as the byre in which the abortion takes place requires to be properly cleaned and disinfected afterwards, one with a cemented smooth floor and no underground drains is to be preferred.

It should be remembered that the aborted calf and placenta are both fertile sources of infection, and these, as well as all discharges, should be buried, burned, or otherwise destroyed. Although the calf may be born alive, it is not a very desirable addition to the stock. Aborted calves often die within a few days of birth. In any case, it is necessary to remember that it is as fertile a source of contagion as if it had been dead, and even more so, as it is capable of moving about, and should be effectually removed from contact with other animals until old enough to be more than once disinfected. It is highly probable that for a short time the fæces of the calf may be contagious.

After abortion the uterus of the cow should be thoroughly cleansed and disinfected. If the placenta does not come away — which is quite common after abortion — it should be removed by the veterinary surgeon before twenty-four hours have elapsed. The uterus should then be flushed out with some reliable antiseptic wash several times daily for a few days, or as long as easy access to it can be obtained. The antiseptic should not be used in a strong condition, but a large quantity of fluid should be run through the uterus. The thorough cleansing and disinfection of the womb not only destroys the contagium and serves to prevent the spread of the disease, but tends to prevent barrenness in the cow and the recurrence of abortion during the next pregnancy.

It should also be remembered that the cattle-man may easily convey the disease on his boots or clothes, and by contaminating fodder or food of any kind quite unsuspectingly spread the disease.

Should any suspicion attach to the bull, or should he have been serving suspected cows, his prepuce should be carefully and gently but thoroughly syringed out with an antiseptic twice daily for several days. Some breeders who have had contagious abortion in their herds have regularly had the bull syringed out—disinfected—each time before and after service, and with the best results. Should there be a lot of strong hair about the orifice of the prepuce, likely to harbour dirt and germs, it should be clipped off and the skin around the opening disinfected.

There is no reason to believe that the organism of contagious abortion multiplies outside the animal body, but as it is possessed of a great amount of vitality (Bang found living bacilli in uterine exudate that had been kept seven months), the greatest care should be taken in disinfecting buildings and everything that could by any possibility have come in contact with the discharges.

Breeders, as a rule, have hitherto been inclined to dispose of their cows after abortion. There cannot be any harm in this if they are fattened and sent to the butcher, but to dispose of a cow that may be carrying the organisms of abortion in her system, as a breeding animal, to whomsoever cares to buy her, is, if not legally a criminal act, undoubtedly one morally, and should never be done. It is now considered a better policy to keep the cows, if they are good ones, disinfect them thoroughly as well as everything they could have been in contact with, and try to get rid of the disease. This has been done successfully, in some cases even during the first season. There is no doubt that replacing the cows which have aborted by purchasing fresh ones is a risky business, as the imported cows frequently abort, and thus serve to maintain the contagion.

It is well to bear in mind the possibility of the disease being conveyed between neighbouring farms by individuals, or the interchange of any commodity that has been in contact with the virus. We have known of cases where this seemed the only possible way by which the disease could have been communicated.

In this country contagious abortion has not yet been scheduled as a contagious disease, but in Norway this has been done since 1894, owners there being required to notify the existence of the

disease in their herds. The restrictions in Norway are not severe, but the notification serves to warn probable buyers against the risk incurred by purchase.

Professor Bang has been experimenting with a view to finding a means of conferring immunity on animals by inoculation, and not without obtaining considerable encouragement, but up to 1908 had not found any practicable method which could be of general application.

BOARD OF AGRICULTURE INQUIRY INTO EPIZOOTIC ABORTION.

In 1905 the President of the Board of Agriculture and Fisheries appointed a Departmental Committee to "inquire, by means of experimental investigation and otherwise, into the pathology and etiology of Epizootic Abortion, and to consider whether any, and if so, what, preventive and remedial measures may with advantage be adopted with respect to that disease." The investigations were begun on temporary premises, and were continued later on a small experimental farm which has been leased by the Board and equipped as a veterinary laboratory. A very considerable amount of experimental and bacteriological work was performed for the Committee by Sir John M'Fadyean of the Royal Veterinary College, London, and Mr Stockman, chief veterinary officer of the Board of Agriculture and Fisheries, and the results are embodied in the Committee's Report. The first part dealing with the disease in bovine animals was issued along with an appendix giving the work in detail in June 1909.

Microbe of Cattle Abortion.

The most definite and important announcement in the first Report is that of the discovery of the microbe of abortion in cattle in Great Britain. Abortion was experimentally induced in cows, ewes, goats, bitches, and guinea-pigs, by introducing into their bodies the microbe found in the uterine exudate of cows that had aborted; but although other species may be experimentally infected in the laboratory, the Committee do not think that they are likely to become infected with bovine abortion in practice except as the result of gross carelessness in the disposal of infected material, and so the conclusion is that "bovine abortion is primarily a disease of cattle."

The bacilli of cattle abortion which proved to be the cause of abortion in cows in these researches are small oval rods, differing in several respects from the abortion bacillus found by Bang in his Danish experiments. But, while the bacillus isolated in England differs in so many material ways from that described in Denmark, the investigations established by exhaustive and laborious studies that the apparent differences arose from a faulty and incomplete study of the biological characters of the bacillus in Denmark, and instead of coining a new name for the bacillus isolated in England the Committee magnanimously suggest that it should be known as "Bang's Bacillus of Cattle Abortion." The English bacillus is non-motile, and is an ærobe —that is, it requires oxygen for its development. It can be cultivated on various substances, such as agar-gelatine-broth-serum, agar, potato, milk, &c. It grows best at temperatures between 30° and 37° C.

Tests made as to the temperature necessary to destroy the vitality of the bacillus of cattle abortion showed that it was not destroyed at a temperature of 55° C. maintained for an hour in the stove, but that after two hours at the same temperature its vitality was destroyed. When it was kept 10 minutes in water at a temperature of 55° C. it retained its vitality, but when kept in water for 10 minutes at a temperature between 59° and 61° C. its vitality was destroyed. The comparatively low temperature at which its vitality is destroyed promises well for the disinfecting effects of the homely bucket of boiling-water.

Microbe of Sheep Abortion. — In regard to abortion in sheep, the Report states that while the bacillus of cattle abortion can experimentally cause abortion in ewes, it was never found in the membranes of ewes aborting in the field: "a totally different microbe—a vibrio—has repeatedly been isolated from outbreaks of abortion in ewes, and has been successfully employed at the laboratory to experimentally infect other ewes pregnant

for the first time. Pregnant cows, however, cannot be infected with this vibrionic abortion of ewes."

Methods of Infection.

The Report states that for experimental purposes the most certain method of infecting an animal with abortion is to inoculate natural virulent material or active cultures into the blood stream. As to natural methods of infection, the virulent material may gain access to the pregnant uterus by the vagina and by the mouth. The Committee do not regard infection by the vagina as likely to very often happen, but are inclined to believe that the disease is more frequently contracted by the mouth than in any other way.

The risks of infection being carried by the bull from one cow to another are regarded as comparatively slight, the Committee stating that "without denying that the disease may be spread by coition, we think that nothing more than a quite subsidiary *rôle* in the spread of epizootic abortion can now be assigned to the bull."

One of the most insidious ways of spreading abortion is the introduction into clean herds of in-calf cows affected with the disease, and it is difficult to guard against this risk, for it is impossible for the ordinary individual to say whether a pregnant animal is affected or not, but in the section dealing with diagnosis the Committee hold out hope that one or other of the new methods they have elaborated for diagnosing the disease in cows before abortion occurs may eventually solve this difficulty.

Cows which have aborted are, of course, a dangerous source of infection. The materials expelled from the uterus of an infected cow in the act of abortion are all virulent, for they contain the microbe, and so also will the discharge from the genital organs for a varying time after abortion. It is still uncertain how long virulent material may remain infective after leaving the animal, but if kept fluid and free from putrefaction it may remain virulent for seven months or even more. This significant consideration increases the importance of careful attention being given to the thorough disinfection or destruction of all materials in connection with aborting cows.

The Committee are not of opinion that many cases of abortion arise from any other cause than infection. They add: "We do not deny that odd cases of abortion may arise from accident or poisoning by such substances as lead, but we have no hesitation in stating that we believe 99 per cent at least of the outbreaks of cattle abortion which assume epizootic characters are due to infection by the bacillus of cattle abortion, and that the fact of a cow having aborted on premises formerly believed to be clean is a sufficient reason for suspecting that the disease has been introduced." They add to this the important statement that there is no difficulty in diagnosing the bacterial disease once an animal has aborted, if an examination of the fœtal membranes be made at an early date after abortion.

Immunisation of Animals.

The investigations have not brought out any evidence that could be regarded as showing that natural immunity from the abortion bacillus is possessed by any individuals of the bovine species. On the other hand, it has been found that there are serious obstacles in the way to a practical success by the use of a protective serum. The protection derivable even from potent serum cannot be depended upon to last more than 2 or 3 weeks, and as the period of the risk of infection extends over at least 7½ months of pregnancy in cows, it is at once seen that it would neither be practicable nor economically possible to give the ordinary cow a sufficient number of doses of a rather expensive serum to protect her from infection during that long period. The idea of hyper-immunising animals for the production of serum was therefore abandoned.

Inoculation with Pure Cultures for the Production of Immunity.—The Report proceeds: "The most hopeful line of inquiry seemed to be the production of immunity by inoculation of large doses of pure culture. One of the great objections to the protective inoculation methods in practice is the number of operations necessary to ensure protection. But owing to the harmless-

ness of large quantities of pure cultures of the abortion bacillus when injected into non-pregnant animals, it seemed possible that whatever degree of immunity could be established by a practicable number of small doses might be conveyed by inoculating one large dose." Trials with pure cultures of the bovine abortion bacillus were therefore made with ewes and heifers, the animals being inoculated about 60 to 148 days before becoming pregnant. The results with sheep were so irregular as to be regarded as of little or no practical value, and these trials were discontinued. With heifers the results were more encouraging. Two heifers were inoculated with a rich liquid culture of the bacillus, the one 148 days and the other 106 days before becoming pregnant. The former heifer, 40 days after becoming pregnant, was inoculated intravenously with 10 c.c. of a dense emulsion of virulent uterine exudate, yet when killed 112 days thereafter she was found free from infection. The immunity of the other heifer "was tested by giving her enormous doses of virulent exudate both by the mouth and the vagina 36 days after becoming pregnant and 142 days after immunisation, and 16 days later she received 10 c.c. of a dense emulsion of a virulent exudate into the jugular vein. She was killed and found free from infection 122 days after receiving the first infecting dose."

These results with heifers, says the Report, "are all the more encouraging when one remembers that not a single negative result followed the intravenous inoculation of unprotected heifers with uterine exudate, and it should be noted also that the tests applied were in point of severity far beyond anything likely to be met with in practice." In addition to the above experiments, they show by infecting experiments on animals which have aborted that these may be absolutely immune to the disease at their next pregnancy.

Curative Measures.

The Report discusses the various methods which have hitherto been most largely used for the prevention and eradication of abortion, and which have already been described, the comment being that it cannot be said "that either singly or collectively they have brought about any material improvement in the general condition of our herds in relation to abortion."

The spraying of the external genital organs and hind quarters of cows with disinfectant solutions is regarded as useless "so long as the animals remain in an infected byre."

As to the isolation of animals as soon as they show signs of abortion, it is remarked that the necessity for this measure is obvious, and cannot be too much insisted upon. "Isolation of the affected animals, however, must be complete immediately before and after the act to be of any real value," and the Report indicates possible methods of accomplishing this.

Carbolic acid and other antiseptics are regarded as useless as curative agents, and "as a preventive agent by internal administration we believe carbolic acid to be equally useless," an opinion which is supported by direct experiment.

The irrigation of the genital passages of animals which have aborted with antiseptic solutions is recommended, "but not on the grounds that the injections will disinfect the uterus. We are of opinion that it will seldom be necessary to continue the injections for more than a month, and that after three months there should be small risk in putting the cow to the bull, provided she is afterwards protected against fresh infection."

Cows which have aborted should not be sold except for slaughter till they have ceased to discharge. The Report states that cows which have once aborted are, as a rule, less liable to infection during a subsequent pregnancy than if they had not before aborted, — are indeed often absolutely immune, though it is known that a considerable number of cows abort twice in succession. The Committee consider "that on infected premises the animals which have already aborted are to be looked upon as valuable assets for purposes of eradication, —much more valuable than new and susceptible animals brought in. We find, however, that a small proportion of those which have aborted will not hold to the bull for an indefinite period after

abortion, and it may be found better to fatten off such animals, unless they are of high value."

The keeping of a goat amongst cows as a preventive against abortion is stigmatised in the Report as the product of "ignorant superstition."

Very properly the Committee speak with reserve as to the part which preventive inoculation is likely to play in the combat with abortion in the field, but the Report would seem to hold out good hope for the future in this direction.

The Board of Agriculture and Fisheries is to be congratulated upon the success of the initial stage of this important and interesting investigation.

MILKING COWS.

The milking of cows is a process that demands greater care and skill than most people realise. The peculiar variations in the milk-yield of cows is due more frequently to imperfect milking than is generally believed. Too much care cannot be given to the operation.

The Udder.—The udder should be capacious, though not too large for the size of the cow. It should be nearly spherical in form. The skin should be thin, loose, and free from lumps, filled up in the fore part of the udder, but hanging in folds in the hind part. Each quarter should contain about equal quantities of milk, though sometimes the hind ones yield the most.

The teats should be at equal distances every way, neither too long nor too short, but of moderate size, and equal in thickness from the udder to the point. When the teat is too long and inclined to taper at the point, it is invariably tough to milk. A medium-sized teat, from 2¼ to 2½ inches long, is considered the most desirable and most easily milked. On the other hand, nothing is more objectionable than too small teats. The teats should be smooth, and feel like velvet, firm yet soft to handle, not hard or leathery. They should yield the milk freely, and not require to be forcibly pulled.

When the milk is first to be taken from the cow after calving, the points of the teats will be found plugged up with a resinous substance, which, in some instances, requires the exertion of some force before it will yield.

Milking Period.—Cows differ much in the time they continue to milk without again bearing a calf, some not continuing to yield it more than 9 months, others for years. The usual time for cows that bear calves to give milk is 10 months. Many remarkable instances of cows giving milk for a long time are on record.

Hours of Milking.—The hours of milking vary in different parts of the country. On small farms, where the milk produced is required for consumption on the holding, the cows are often milked three times daily—morning, noon, and evening. In the great majority of dairy herds the milking takes place twice daily—early in the morning, and in the evening or late in the afternoon. The precise hours vary according to local habit, which is regulated mainly by the use made of the milk. Where the milk has to be sent long distances to market the morning milking takes place from 3 A.M. onwards, and the afternoon milking from 4 P.M. onwards. More general hours are from 5 to 6 A.M. and 5 to 6 P.M.

Hours of Milking and Percentage of Butter-fat.—Careful observation has shown that the tendency of the evening's milk to be richer than the morning's milk in butter-fat is partly due to the fact that the interval between the evening and morning hours of milking is usually longer than the interval between the morning and evening hours of milking. The discovery of this has led to the intervals being more nearly equalised. Why the differences in the intervals should have this effect is a problem that still awaits solution.

Milk-pails.—The vessel used for receiving the milk from the cow was at one time mostly made of thin oak staves bound together with thin galvanised hoops, but the pail now most generally in use on all properly conducted dairy-farms is made of tinned iron or tin, and is preferable for cleanliness and lightness. This pail should be 3 to 4 inches wider at the mouth than the bottom, and when placed between the milker's knees

ehould be deeper at the under side in order to prevent spilling of the milk when held in a slanting position. The pail should be large enough to contain all the milk that a cow will give at a milking without becoming quite full. It is undesirable to annoy the cow by rising from her before the milking is finished, or by exchanging one pail for another.

The milking-stool, as in fig. 744, is made of wood, to stand 9 inches in height, or any other height to suit the convenience of the milker, with the top 9 inches in diameter, and the legs a little spread out below to give the stool stability. Some milkers do not care to have a stool, and prefer sitting on their

Fig. 744.—*Milking-stool.*

haunches; but a stool keeps the body steady, and the arms have more freedom to act, particularly to prevent accidents to the milk in case of disturbance by the cow.

Cows holding back Milk. — The holding back of milk is a curious property which cows possess. How it is effected is not very well understood, but there is no doubt of the fact occurring when a cow becomes irritated or frightened by any cause. Cows should therefore at all times be treated gently, and neither struck nor shouted at. The cow will yield more milk to the skilled milker than to an unskilled person, who may tug and pull the teats instead of gently squeezing them. Not all are affected to the same degree; but, as a proof of their extreme sensitiveness in this respect, it may be mentioned that very few can be milked so freely by a stranger as by one to whom they have been accustomed.

The Milking Side. — Usually, the near side of the cow is taken for milking, and it is called the *milking side.* Some think cows should always be milked on the same side, but in many dairies where the cows are stalled in pairs the milker steps up between the cows and milks the one from the left side and then turns round and milks the other from the right side. This practice is to be commended. It is rare to see a cow milked in Scotland by a man, and women as rarely do the milking in England.

The Operation of Milking.—Milking is performed in two ways, stripping and nievling. *Stripping* consists of seizing the teat firmly near the root between the front of the thumb and the side of the forefinger, the length of the teat lying along the other fingers, and of pressing the finger and thumb while passing them down the entire length of the teat, and causing the milk to flow out of its point in a forcible stream. The action is renewed by again quickly elevating the hand to the root of the teat. Both hands are employed at the operation, each having hold of a different teat, and moving alternately. The two nearest teats, the fore and hind, are first milked, and then the two farthest. In the case of cows with properly sized teats stripping should be resorted to only at the finish of milking in order to draw out the last drops.

Nievling is done by grasping the teat with the whole hand, or *fist*, making the sides of the forefinger and thumb press upon the teat more strongly than the other fingers, when the milk flows by the pressure. Both hands are employed, and are made to press alternately, but so quickly in succession that the alternate streams of milk sound on the ear like one forcibly continued stream; and although stripping also causes a continued flow, the nievling, not requiring the hands to change their position, as stripping does, draws away a large quantity of milk in the same time.

Thus stripping is performed by pressing and passing certain fingers along the teat, and nievling by the doubled *fist* pressing the teat steadily at one place.

Of the two modes the *nievling* is preferable, because it is more like the sucking of a calf. When a calf takes a teat into its mouth, it seizes it with

the tongue against the palate, causing them to play upon the teat by alternate pressures or pulsations, while retaining it in the same position. Nievling does this: the action of stripping is quite different.

Milking should be done *fast*, to draw away the milk as quickly as possible; and it should be continued as long as there is a drop of milk to bring away.

An Improved System of Milking.

An improved system of milking was introduced into Denmark by Mr Hagelund, an eminent veterinary surgeon. It is claimed for this system that not only is an increased flow of milk obtained but a slight increase of butter-fat as well. The process consists of manipulating or massaging the udder in a special way, first by rubbing gently with a dry cloth, this process not only cleaning the udder but tending to bring down the milk into the teats; next, by milking slowly at first the two front teats and then the two rear ones alternately until all is drawn that will come in this way. The udder is then manipulated in the following manner:—

First.—The right quarters of the udder are pressed together by placing the left hand on the hind quarter and the right hand in front of the fore quarter, the thumbs being placed on the outside of the udder and the four fingers between the two divisions of the udder. The hands are now pressed towards each other, and at the same time lifted towards the body of the cow. The pressing and lifting are repeated three times, the milk collected in the milk-ducts is then drawn out, and the manipulation repeated until no more milk is obtained, when the left quarters are treated in similar manner.

Second.—The glands are pressed together from the side. The fore quarters are milked each by itself by placing one hand with the fingers spread on the outside of the quarter, and the other hand in the division between the right and left fore quarters; the hands are pressed against each other, and the teat then milked. When no more milk is obtained by this manipulation the hind quarters are milked by placing a hand on the outside of each quarter, likewise with fingers spread and turned upward, but with the thumb just in front of the hind quarter. The hands are lifted and pressed into the gland from behind and from the side, after which they are lowered to draw the milk. This manipulation is repeated till no more milk is obtained.

Third.—The fore teats are grasped with partly closed hands and lifted with a push towards the body of the cow, both at the same time, by which method the glands are pressed between the hands and the cow's body. This is repeated three times, and the teats are then stripped dry. When the fore teats are emptied the hind ones are treated in a similar manner.

The process thus described may seem elaborate and intricate, but in actual practice it is quite simple, and cows in full milk can be milked by an expert milker in from six to eight minutes. It had long been known by observant dairymen that the flow of milk from a cow may be increased by gentle manipulation of the udder: indeed all skilled milkers have in the past been in the habit of bringing the hand gently round the udder before commencing to milk, but no systematised method had been adopted or published till it was adopted in Denmark. Now it is being largely practised at Scandinavian dairy farms and in the United States of America.

Milking-Machines.

During the closing decade of the nineteenth and the opening decade of the twentieth century quite a number of milking-machines have been put on the market, the inventors claiming that each in turn had solved the milking problem.

In many cases where dairy farmers had fitted up expensive machines it was found that whilst they milked fairly satisfactorily when the cows were in full milk, the operation was less efficient when the cows were drying off, and in many cases hand-milking was again resorted to. In other cases, the machine was dispensed with on account of the keeping properties of the milk being impaired.

Two Scottish milking-machines—the Lawrence-Kennedy and the Wallace—have stood the test of practice better

than the earlier inventions, and a good many farmers both in this country and abroad are using them with a fair measure of success.

These two machines are similar in their main features, both working on the suction principle. By means of an exhaust pump a vacuum is created in a system of piping which is attached to the cow's teats by rubber cup and which leads into sealed milk-pails: ingenious contrivances impart to the teat-cups a pulsating movement which closely resembles the sucking action of the calf, and in this way the milk is drawn from the cow. Fig. 745 represents the teat-cups and milk-pail of the machine made by J. & R. Wallace, Castle-Douglas.

A simpler appliance is the self-acting milker. In this system the milk flows by gravitation through perforated siphons inserted into the teats. This method, however, is rarely used except in the case of sore teats or udder.

Spaying Cows.

The spaying of cows has sometimes been practised to secure the permanency of milk without continued calf-bearing. The operation of spaying a cow, which is

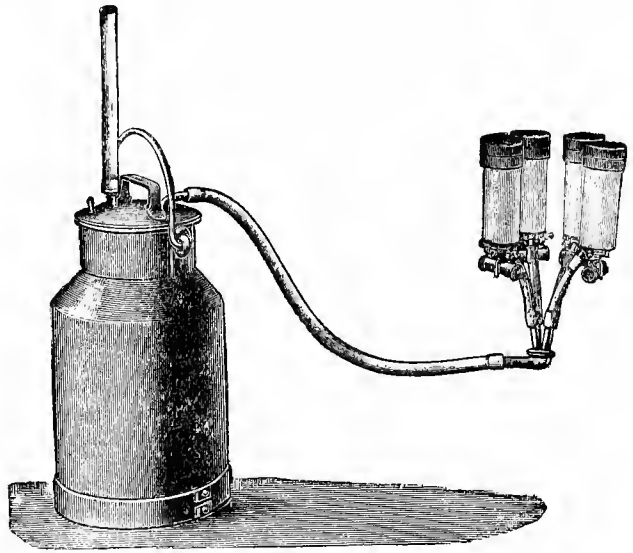


Fig. 745.—*Wallace's milking-machine—Teat-cups and milk-pail.*

performed some time after calving, consists in cutting into the flank of the cow, and, by the introduction of the hand, destroying the ovaries of the womb. The cow must have acquired her full stature, so that it may be performed at any age after 4 years. She should be at the flush of her milk, as the future quantity yielded depends on that which is afforded by her at the time of the operation. The operation may be performed in ten days after calving, but the best time appears to be 3 or 4 weeks after. The cow should be in robust health, otherwise the operation may kill her or dry up the milk. The only preparation required for safety in the operation is, that the cow should fast 12 or 14 hours, and the milk be taken away immediately before the operation.

The wound heals in a fortnight or three weeks. For two or three days after the operation the milk may diminish in quantity; but it regains its measure in about a week, and continues in full flow for the remainder of the animal's life, or as long as the age of the animal permits the secretion of the fluid, unless from some accidental circumstance—such as an attack of a severe disease—it is stopped. But even then the animal may easily be fattened.

Advantages of Spaying.—The advantages of spaying are: "1. Rendering

permanent the secretion of milk, and having a much greater quantity within the given time of every year. 2. The quality of the milk being improved. 3. The uncertainty of, and the dangers incidental to, breeding, being to a great extent avoided. 4. The increased disposition to fatten, even when giving milk, or when, from excess of age, or from accidental circumstances, the secretion of milk is checked; also the very short time required for the attainment of marketable condition. 5. The meat of spayed cattle being of a quality superior to that of ordinary cattle."[1] With these advantages breeders of stock can have nothing to do; but since the operation is said to be quite safe in its results, it may attract the notice of cowfeeders in town.

FEEDING OF COWS.

In the feeding as in the general treatment of cows, practice varies greatly. The conditions which most largely regulate these variations are, the class or breed of cows, the purposes for which they are kept, the locality, and general systems of farming pursued.

Dairy Herds.

As would be expected, where *dairying* is the sole or dominant feature in the system of farming, the cows are fed and managed differently from what they are in *mixed farming*, where cows are kept chiefly to breed and rear calves, and provide milk and butter to the farmer's household. Again, even within the limits of dairying itself, there are distinctive conditions which induce different methods of feeding. Where the main object is the production of milk for disposal as milk, the feeding differs—unfortunately, sometimes differs too much for the quality of the milk—from that considered best for butter-production. Then surrounding circumstances, such as the varieties of food which may be most easily and most cheaply grown or procured, also tend to regulate and modify the systems of feeding; while it is well known that food which does well with one lot of cows is often less acceptable and profitable as food for others. Thus it becomes manifest that there are good reasons for great variations in the systems of feeding cows.

Regarding the details of the systems of feeding cows pursued in dairy herds throughout the country little need be said here. Information on the subject is already given in the sections of this volume dealing with the management of pure breeds. The exceptionally bountiful methods of feeding pursued in the herds of Ayrshire cows are described in pages 114 and 115 of this volume. Of the detailed systems followed in herds of Jersey and Guernsey cattle, particulars will be found in pages 132 and 134. A typical system in dairy herds of Shorthorn and Shorthorn crosses is indicated at page 93, and the highly successful method of feeding pursued by Mr John Evens in his famous milking herd of Lincolnshire Red Shorthorns is described at page 96.

Regulating Food by Yield of Milk.—There are few points of greater importance in connection with the management of cows than that of maintaining the proper relation between the allowance of food and the production of milk. Fortunately a good deal of attention has been given to the investigation of this aspect of the question in recent years, and, generally speaking, the feeding of dairy cows is now carried on upon much more economic lines than till wellnigh the close of the nineteenth century.

Typical Rations.—The typical rations noted below are arranged in relation both to the weight of the cows and the quantity of milk they are yielding. They are based on experience gained in trials conducted in connection with the Durham College of Science, Newcastle-on-Tyne.[1]

No. 1.—Ration for cows giving 18⅓ lb. of milk (roughly 1⅝ gallon) per day.

Quantities for cows 9 cwt. live-weight and giving 16½ lb. of milk daily are given within brackets.

39 lb. swedes or 52 lb. yellow turnips (35 lb. or 47 lb.)
19 lb. oat-straw (17 lb.)
4¾ lb. decorticated cotton-cake (4¼ lb.)

Roughly speaking, 1 lb. less of decorticated cotton-cake might be given if the yield is 12½ lb. of milk daily instead of 18⅓ lb. daily.

[1] Ferguson's *Distem. among Cat.*, 29-36.

[1] *Jour. Board of Agric.*, March 1909.

No. 2.—Ration for cows giving 30½ lb. of milk (roughly 3 gallons) per day.

Quantities for cows 9 cwt. live-weight and giving 27½ lb. of milk daily are given within brackets.

46½ lb. swedes or 62 lb. yellow turnips (42 lb. or 56 lb.)
19 lb. oat-straw (17 lb.)
6⅔ lb. decorticated cotton-cake (6 lb.)
4½ lb. undecorticated cotton-cake (4 lb.)

No. 3.—As for No. 2, with hay instead of oat straw.

Quantities for cows 9 cwt. live-weight and giving 27½ lb. of milk daily are given within brackets.

46½ lb. swedes or 62 lb. yellow turnips (42 lb. or 56 lb.)
19 lb. meadow-hay (17 lb.)
5 lb. decorticated cotton-cake (4½ lb.)
3⅜ lb. Indian cotton-cake (3¼ lb.)

Heavy milkers, giving about 4 gallons of milk daily, should have all the foods of the best quality possible, and might be given either of the following additions to Ration No. 3:—

2 lb. seeds hay, 2 lb. linseed-cake, 1 lb. maize-meal } or { 2 lb. linseed-cake. 2½ lb. maize-meal.

Ration No. 1 might also have hay substituted for oat-straw, and if so the decorticated cotton-cake could be reduced by about 2 lb. daily. This, however, is not quite an exact equivalent. In any of these rations the roots can be considerably reduced if desired and a substitute used.

Rations for Dry Cows.

Cows giving reduced quantities of milk as the lactation period progresses should have the concentrated food given to them lessened; but cows that are heavy milkers and have become lowered in condition, owing to their heavy milk yields, must not have the food restricted too greatly, but must be allowed to regain condition before coming to the next calving.

For cows that are to be fattened off at the close of their milking periods, the ration should not be reduced as indicated above, but should be gradually altered as the flow of milk decreases to that suitable for fattening animals. Cows of 10 cwt. live-weight, dried off previous to calving, would probably do well with either of the following rations. The quantities for cows of 9 cwt. live-weight are given within brackets.

No. 1.—39 lb. swedes or 52 lb. yellow turnips (35 lb. or 47 lb.)
19 lb. oat-straw (17 lb.)
2¾ lb. maize-meal (2½ lb.)
2½ lb. decorticated cotton-cake (2¼ lb.)

No. 2.—39 lb. swedes or 52 lb. yellow turnips (35 lb. or 47 lb.)
19 lb. meadow-hay (17 lb.)
2¼ lb. maize-meal (2 lb.)
2/7 lb. decorticated cotton-cake (¼ lb.)

The following are the winter rations given to cows in four dairy herds in Scotland, the cows in herd No. 4 being Shorthorns or Shorthorn crosses, and in the others mostly Ayrshires:[1]—

Herd No. 1.	Per cow per day.
Turnips (yellow) or mangels	43 lb.
Straw (oat)	9½ „
Hay (Italian and clover)	6½ „
Meals (bean, pea, rice and dec. cotton-cake)	8 „
Bran	1½ „
Treacle	½ „
Distillers' grains or draff (wet)	10 „

The roots are fed whole, mid-forenoon and afternoon, and the meals three times daily. A portion of the straw is cut long and mixed in the cooler with the meals and draff for each lot of animals. This is done immediately the cows have been fed. Hot water is then run on the mass in sufficient quantity to thoroughly wet it, the whole being left lying in this condition till next feeding-time, when it is fed at about blood-heat. There is always plenty of the coarsest of the straw left uneaten to sufficiently litter the animals.

Herd No. 2.	Per cow per day.
Turnips or mangolds (raw) (Some of these are steamed.)	40 lb.
Hay	11 „
Corn, chaff, or cut straw	3½ „
Bean-meal	3½ „
Undec. cotton-cake	3 „

[1] *Trans. High and Agric. Soc.*, 1909.

Herd No. 3.	Per cow per day.
Turnips	28 lb.
Straw	7 „
Hay	4 „
Bean-meal	4 „
Bibby dairy meal	3 „
Bran	1½ „
Treacle	1 „

Herd No. 4.	Per cow per day.
Turnips	78 lb.
Straw	24 „
Pease-meal	3 „
Compound cake	2½ „
Dried brewers' grains	2 „
Cummins (barley sprouts)	2½ „

Dairy Cows in Summer. — Little need be said as to the feeding of cows in summer. They are kept mainly on pasture, sometimes getting allowances of concentrated food according to the supply and quality of the pasture, the condition of the cows, and the quantity of milk they are giving. Recent trials have indicated that on reasonably good pastures cows rarely give a sufficiently increased yield of milk to pay for extra food.

Feeding Dry and Breeding Cows.— This point is also dealt with in the sections relating to breeds of pure-bred cattle. The foregoing notes relate mainly to the feeding of cows where the production of milk is the chief, or at any rate a specially important, consideration, and where, on this account, the cows are fed with such quantities and qualities of food as are calculated to stimulate and maintain a bountiful flow of milk. In herds in which the yield of milk is a secondary consideration, the systems of feeding are somewhat different, and, as a rule, the rations are arranged upon a more moderate scale.

Then, in all cases, cows are fed more sparingly when not giving milk. By far the most general practice is to feed dry cows upon oat-straw or hay and turnips or mangels. Formerly turnips were given to cows much too freely. Large meals of cold watery turnips are positively injurious to cows that are heavy in calf; and in all respects it is better practice to feed roots sparingly to cows. About 50 or 60 lb. of roots per day, given in two meals, are now very general quantities in well-managed herds, and with plenty of good sound fodder, either oat-straw or hay, or both, the cows should thrive well and sustain no harm. Many still give larger quantities of turnips, but dry cows may be kept in good condition with even less than 40 lb. of roots, as is often the case where the pulping system is pursued, or where recourse is had to warm mashes composed of cheap food, largely of chopped hay, straw, chaff, and perhaps a few roots.

In England dry cows are usually kept on hay, straw, and turnips or mangels, and in many cases they receive no roots of any kind. With plenty of good hay, a run out daily—in fine weather, of course,—free access to water, and perhaps a small allowance of bran or some other cheap food, they thrive fairly well.

It is not a good plan, however, to let cows get low in condition, and this is sometimes allowed to happen by too poor feeding when they are wholly or partially dry.

EFFECTS OF VENTILATION AND TEMPERATURE ON MILK-YIELD.

The extent to which milk-yield may be affected by variations in the temperature in which cows are kept has long been an open question. The opinion has been widely held that in the winter months in this country it was only by keeping cows moderately warm that the maximum yield of milk would be obtained. It has also been extensively believed that if the temperature of a byre were allowed to fall to say 40° F., or lower, there would in consequence be a marked decline in milk-yield from cows kept in that byre. But while these have hitherto been the prevailing views, a few dairy farmers of an inquiring turn of mind began, towards the end of the last century, to doubt whether those views were well founded.

Experiments with Cows.

In 1907 the subject was brought before the Highland and Agricultural Society of Scotland by Mr John Speir, Newton, Glasgow, and it was resolved to conduct a series of experiments in the hope of

solving the problem. In the winter and spring of 1908-9 two similar lots of cows at five farms in different parts of Scotland were fed and housed alike, except that the byre containing one lot was freely ventilated in all weathers, so that its air, which was relatively pure, was kept comparatively cool, and that in the other byre the ventilation was so restricted that the temperature was maintained at about summer temperature.

It was intended to have a difference of about 10° F. between the temperatures of the two byres. This was very nearly attained, the general average for the whole period of the experiments — 18 weeks—being 49.82° in the freely-ventilated byres and 59.40° in the byres with restricted ventilation.

The results obtained, which are extremely interesting, are reported fully in the *Transactions* of the Society for 1909.[1] The following table gives a summary of the yield by the two lots of cows :—

YIELD OF MILK IN FREE *VERSUS* RESTRICTED VENTILATION.

FOR 18 WEEKS—FROM 22ND NOVEMBER 1908 TO 27TH MARCH 1909.

Farm.	No. of cows in each lot in "A" and "B."	"A"—FREE VENTILATION:				"B"—RESTRICTED VENTILATION.			
		Total milk in lb.	Milk per cow per day in lb.	Average per cent of fat.	Average temperature of the byre.	Total milk in lb.	Milk per cow per day in lb.	Average per cent of fat.	Average temperature of the byre.
Newton .	18	60,302.5	26.6	3.65	49.35	59,453.6	26.1	3.59	60.81
Woodilee .	10	29,242.7	24.6	3.38	52.24	29,011.5	24.4	3.27	60.57
Crichton .	8	25,811.0	27.0	3.66	50.50	26,055.5	27.4	4.58	59.40
Hartwood .	8	30,509.0	32.5	3.33	47.87	31,627.0	33.7	3.44	56.00
*Rosslynlee .	6	12,466.0	30.2	3.82	48.92	11,185.5	27.1	3.43	57.53
Total . .	100	158,322.2	...	...	...	157,333.1	...	...	...
Average milk per cow per day for the whole period			27.5	3.55	...	...	27.3	3.49	...
Difference					...	989.1	.2	.06	...
Average temperature in proportion to the cows					49.82	...	...	...	59.40
Difference					9.58	...	...	...	...

* For 10 weeks only.

It is thus seen that the popular belief in the advantage for milk production of a warm temperature as attained by restricted ventilation was not supported by these experiments. In the total yields of milk of the two lots of 50 each in eighteen weeks there was a difference of only about 100 gallons—less than ¼ lb. of milk per cow per day. In other words, cows kept in an average temperature of 49.82° F. gave slightly more milk per day over a period of eighteen weeks than cows kept in an average temperature of 59.40° F.

It will be observed that in percentage of butter-fat in the milk, the advantage lies also on the side of free ventilation, the averages being 3.55 and 3.49 per cent.

Even more remarkable than the results, as seen in the general averages for the whole period, are the records of the

[1] *Trans. High. and Agric. Soc. of Scotland*, fifth ser., vol. xi., 1909.

yields of milk obtained in two periods of exceptionally cold weather that occurred in the course of the experiments. In the first cold period (four days in December) the average temperature of the cold byres was 41.2° F., and the average yield of milk per cow, 29.0 lb. per day. In the same byres the average temperature for the four days before and the four days after the cold period was 53.76° F., and the average yield of milk per cow per day precisely the same as in the four cold days, with a lower temperature of 12.56° F. Another cold period occurred in March, and the results obtained in it agree entirely with those of the first cold period.

General Conclusions.

The most important general conclusions drawn from these experiments are:—

1. That fresh air is a much more important factor in the production of milk in mid-winter than it is generally considered to be by milk-producers in this country. While most people agree to the need of fresh air in regard to the health of the animals, it seems almost as desirable in mid-winter if a full supply of healthy milk is to be produced.
2. In order that the greatest advantage may be derived from the fresh air, the animals should at no time have the ventilation restricted in autumn, but should be kept as cool as possible, so that they may not only retain all their hair, but if necessary increase it.
3. There is no difficulty, much less impossibility, in producing milk in freely ventilated byres in the coldest weather likely to be met with in this country, if the cows are kept sufficiently cool in early autumn.
4. While the present experiment shows that rather more milk has been produced under conditions of free ventilation than where ventilation was restricted, it would be injudicious, till these results have been corroborated by other trials, to consider that this will invariably happen. It is unquestionable that the general health of the cows would be better under free than under restricted ventilation.
5. Milk produced in a building kept at a high temperature by restricted ventilation, or during a warm period, does not seem to be any richer in fat than that produced at a low temperature or during cold weather.
6. It seems hopeless to expect to be able to keep the air of any byre, no matter how constructed, at from 60° F. to 63° F. during the ordinary weather of an average winter without excessive pollution of the air.
7. Any saving in food which is effected by keeping the animals at a higher temperature seems to be equalled, if not exceeded, by improved digestion when they have plenty of fresh air but a lower temperature.
8. There is reason for believing that those great scourges of the dairyman, mammitis or weeds and tuberculosis, may be considerably reduced if cows are kept in freely ventilated byres in winter.

CALF-REARING.

It is only too true that calf-rearing, the root and the rise of the cattle-breeding industry, has not received from the general body of farmers such full and careful attention as it deserves, or as it is capable of repaying. It is undeniable that the live-stock resources of the United Kingdom might advantageously be developed to a much greater extent. The growing importance of live-stock interests in British agriculture is manifest to all. In this expansion calf-rearing must play a leading part. Breeding is of course the starting-point, and the rearing of the calf is the first great step in the progress of the industry.

Aversion of Farmers to Calf-rearing.—With many farmers calf-rearing finds little favour—often, one may venture to say, for no better reason than that it is a troublesome business, demanding constant and careful attention. With skilful and careful management,

calf-rearing, where circumstances are at all favourable, is almost invariably remunerative. This much, however, it must have, and it rarely succeeds where not well conducted. The young animals must be fed with skill and regularity, and their health and comfort carefully attended to in every way. When this responsible work is left entirely to hired servants, it may be imperfectly or irregularly performed, with the result that the calves make unsatisfactory progress, or perhaps become impaired in health. The farmer thus loses faith in the benefits of calf-rearing. He has, perhaps, at last learned that the cause of the mischief is improper treatment; but personal supervision, or supervision by some member of his family or employees in whom confidence could be placed, may be found irksome or inconvenient, and thus again the industry of calf-rearing loses in favour.

Calf-rearing on Large Farms.—This demand which calf-rearing makes upon the careful personal supervision of the farmer or some member of his family, is undeniably the main reason why upon many large farms well suited for breeding, so few calves are brought up. A little of the blame for this may be laid at the door of modern social fashion. Upon a large farm the farmer himself has many other duties which draw him away from superintending the feeding and treatment of calves; and it is not the fashion for sons and daughters of large farmers to give their attention to such matters. This conception of social life upon the farm may easily be carried too far. It is not suggested that the sons and daughters of men of capital should be expected to put their hands to the manual work of calf-rearing. There is a difference between this, however, and the superintending of work done by hired servants. The daughters and sons of farmers will be none the less ladies and gentlemen if they make themselves acquainted with certain details of their father's business, and assist him in seeing that these details are carried out with due care and regularity.

Deficiency of Store Cattle.—The growth in the breeding of cattle has not kept pace with the increase in the consumption of beef. The supply of home-bred store cattle has not been equal to the demands of the feeders. Farmers have been complaining of unsatisfactory financial results from fattening cattle, and the main difficulty has been the fact that, on account of deficient supply, store cattle have been dearer than fat animals —that feeders have had to pay more for the lean cattle than the price of beef would warrant.

Home-breeding, not Importation, the Remedy.—The proper remedy for this state of matters is the extension of home-breeding — assuredly not the importation of foreign lean cattle. Let that be resorted to only when our own resources in cattle-breeding have been developed to the fullest advantageous extent. We are far short of that limit yet; and one would fain hope that until it is reached the best efforts of our leaders of agriculture may be directed to the encouragement of home-breeding rather than to the devising or providing of means of increasing the embarrassments of home-breeders by importing foreign-bred lean stock.

Rear more Calves.—In any scheme for increasing the supply of home-bred store cattle, calf-rearing must play an important part. We must not only breed more calves, but we must also rear more. We should rear all we breed, or nearly so, and rear them well, too; for let it ever be kept in view that what an animal loses with bad treatment as a calf, it can hardly ever fully recover. But by rearing well, one does not mean any sort of extravagant treatment. As a matter of fact, there is in many cases room for much greater economy in the rearing of calves. In connection with calf-rearing on dairy farms, or wherever milk can be turned to good account, this point is of special importance.

Breed longer from Cows.—Cows that prove to be good breeders should be bred from to a greater age than is the general rule at present. A custom by no means uncommon is to buy a cow for a temporary supply of milk, and fatten her off when she gets dry. Now this is a serious loss. Breed from all suitable cows as long as practicable.

Breeding from Heifers.—From all heifers that are suitable, whether intended for cows or not, take one, two, or

perhaps even a third calf. Keep them well all the while, letting the calves suckle; and if the heifer is not to be kept for a cow, she may be fattened off and sold as heifer-beef. The calf or two will have done her little or no harm in the butcher's eye, if only she does not show the udder of a cow. This will not often arise when the calves suckle. This question was put to an extensive salesman in the north of England, who replied that his experience was that two calves or so in no way spoiled the sale of the young heifer, if only there were no display of udder, and if she were plump, level, and well fattened. He added that a lot of young heifers never came before him for sale but he regretted that so much valuable material was being wasted. Premature fatting of heifers is really killing the goose that lays the golden eggs. In these times farmers cannot afford such waste as that.

Are Calves Nuisances?—Unfortunately not a few dairy farmers look upon calves as little else than nuisances—as necessary evils,—something which they would never wish to have if only they could without them get cows in milk. This is a great misfortune, and shows clearly that while the cry is for more store stock, there must be something radically wrong somewhere. The fact is, calf-rearing is very imperfectly understood.

It is undeniable that dairy farmers, as well as other farmers in all parts suited for breeding, would find, in well-conducted calf-rearing, returns which would amply repay careful treatment and judicious and liberal feeding. The dairy farmer may dislike the calf because he has found it a greedy and bad-paying customer for its mother's milk. But if he has done so, he has had himself to blame. A good calf will well repay a moderate allowance of its mother's milk for a short time; and one would emphasise this point, that it is only for a very short time at the outset that there is any necessity to give milk—at any rate, new milk—to calves.

Milk Substitutes.—Scientific research and commercial enterprise have placed us in possession of many advantages unknown to our forefathers. In the simple matter of calf-rearing much has been gained in this way. Why, the market is teeming with cheap milk substitutes; and, without going the length of affirming that these foods are worthy of all their energetic vendors say of them, yet one may unhesitatingly say that, with substantial advantage to themselves and the general public, farmers might draw upon them much more largely than they have done heretofore. Undoubtedly the use of these prepared foods is on the increase; and by a judicious use of them and other simple natural foods, calf-rearing might be increased to a very great extent, both on dairy and mixed husbandry farms.

Rearing or Selling Calves.—It is not suggested that all farmers should rear their calves. It may suit some better to sell the calves when one, two, or three weeks old. If the calves are of a good class they will sell readily at handsome prices. While it may suit some to breed calves and sell them young, it will undoubtedly pay others to adapt their arrangements specially for rearing. Instead of keeping large stocks of cows, they may buy in young calves, and rear them partly on milk and other suitable food. In certain cases these bought-in stock may be carried on and fattened when about two years old or less. In others they may be simply reared, and sold as lean stock when from ten to eighteen months old.

Housing Calves.

The comfortable and economical housing of calves is a matter that demands careful attention. Calves are either suckled by their mothers, or brought up by the hand on milk and other substances. When they are suckled, if the byre be roomy enough—say, about 18 feet in width—calves may be tied up to the wall behind the cows; or, what is a less restrictive plan, they may be put together in large loose-boxes at the ends of the byre, or in an adjoining apartment, and let out at stated times to be suckled.

When brought up by the hand, calves are put into a suitable apartment, preferably each in a crib to itself, where the milk is given to them. The advantage of having calves separate is, that it prevents them, after having had their allow-

ance of milk, sucking one another, by the ears, teats, scrotum, or navel, by which malpractice ugly blemishes are at times produced. When a number of calves are kept together, they should all be muzzled to prevent this sucking.

Calf-crib. — The crib for each calf should be 4 feet square and 4 feet in height, sparred with slips of tile-lath, and have a small wooden wicket to afford access to the calf. The floor of the cribs, and the passages between them, should be paved with stone, or laid with asphalt or concrete, though asphalt and concrete make cold floors which should be well covered with litter. Abundance of light should be admitted, either by windows in the walls or sky-lights in the roof; and fresh air is essential to the health of calves, so that ventilation should be carefully attended to. So also should the cleaning of the calf-cribs. The cribs should be regularly cleaned out; and it is a good plan to sprinkle the floors daily with some disinfectant, such as diluted carbolic acid—one part of acid to twenty of water. This will keep the atmosphere pure and wholesome, which is very desirable for the young animals.

The crib should be fitted up with a manger to contain cut turnips or carrots, and a high rack for hay, the top of which should be as much elevated above the litter as to preclude the possibility of the calf getting its feet over it.

The general fault in the construction of calves' houses is the want of light and air—both great essentials; light being cheerful to animals in confinement, and air essential to the good health of calves. When desired, both may be excluded. Calf-houses are often also too cold. The walls of the house should be plastered, to be neat and clean, and should be lime-washed at least once every year.

In some cases the cribs are so constructed that the calf has access, either at will or when the door of the crib is opened, to a larger enclosure in which the young animal can exercise its limbs.

Care in letting out Calves.—When the calves are fit to be put out in the open air, after it becomes mild, they should be put into a shed for some nights before being turned out to grass, and also for some nights when at grass. When put right out to the open from the crib they are apt to run about so much as to get chills, but this risk is lessened by the calves being loose in a shed for a little time before being put out. The shed should be fitted up with mangers for turnips, racks for hay, and a trough of water.

Calf's First Food. — The first food the calf receives is the biestings—the first milk taken from the cow after calving. It is of the consistence of the yolk of an egg, and is an appropriate food for a young calf. By the time it gets its first feed, the calf may have risen to its feet. If not, let it remain lying, and pour a little of the biestings into its mouth, introducing a finger or two with it for the calf to suck, when it will swallow the liquid. Let it get as much as it is inclined to take. When it refuses to take more, its mouth should be cleaned of the biesting that may have run over.

Composition of Biestings. — The biestings or first milk after calving differs considerably in composition from ordinary milk. It contains an exceptionally large proportion of casein or cheesy matter, as the following analysis of ordinary milk and biestings will show:—

	Ordinary Milk.	Biestings.
Casein (cheese) .	3.30	4.83
Butter fat . .	3.40	3.37
Milk-sugar . .	4.55	2.48
Albumen . .	0.60	15.85
Ash . . .	0.75	1.78
Water . .	87.4	71.69
	100.00	100.00

Feeding Calves.

Reform in Calf-feeding.—In the method of feeding calves during the first few months of their existence, there has been almost as great a revolution as in any other branch of farm practice. The old notion, that at least three months of feeding upon whole milk as it comee from the cow was necessary for successful calf-rearing, has been exploded. In many cases, almost entirely in herds of pure-bred cattle, the calves still suckle their dams. But beyond these herds comparatively little new milk is now employed in rearing calves, reliance

being more largely placed upon skim-milk and milk-substitutes.

The introduction of the cream-separator led to important improvements in the system of calf-rearing. Although bereft of nearly all the butter-fat, separated milk is usually more wholesome for calf-rearing than skimmed milk. Separated milk is fresh and sweet, while in the case of skimmed milk a certain amount of change may have taken place which more than counteracts the advantage of the additional percentage of butter-fat.

Calf-feeding in Pure-bred Herds.—The methods of feeding calves pursued in herds of pure-bred cattle are detailed in the sections of this volume dealing with these breeds. Nothing need be added here in regard to pure-bred calves. The methods, it will be seen, vary considerably, yet there is a general agreement in the main features.

Calf-feeding in Ordinary Mixed-bred Herds.—The feeding of calves in ordinary mixed-bred stocks does not differ fundamentally from that in pure-bred herds. The general principles are the same in both cases. The main difference comes in on the score of economy. In pure-bred herds the main purpose aimed at is often the fullest possible development of the animal regardless of a little extra cost in the process of feeding. In ordinary commercial stocks strict attention must be given to economy from the very outset. Thus, as a rule, in the latter case the cheaper feeding materials are more largely used than in pure-bred herds.

Suckling and Hand-rearing.—Suckling, of course, is nature's method of calf-rearing. As has been seen, it is followed largely in pure-bred herds. For ordinary fattening stock it is too expensive, and in this case is rarely pursued, except with cows that have just had their first calves, or where two calves are put to one cow. Hand-rearing is by far the most widely prevalent system.

Prevalent Methods.—Perhaps the most widely prevalent method of rearing calves is to feed them entirely on new milk for a short period at the outset—that period varying from two to six weeks,—and afterwards partly on new milk, separated milk, and artificial food; or upon separated milk and artificial food, without any of the rich milk as it comes from the cow. It is, no doubt, a good plan to let the calf have all the new milk it can readily consume for at least two or three weeks at the outset. By degrees separated or skimmed milk may be substituted for new milk, and when the new milk is wholly, or almost wholly, withdrawn, the separated or skimmed milk must be supplemented by some other richer food.

Separated Milk for Calves.—Separated milk alone is not a well-balanced food for calves. As the butter-fat has been almost wholly removed from it, the remaining constituents are not sufficient for the healthy development of the young animal. Skim-milk, left by an efficient system of creaming, will, on an average, contain the following per 100 lb.:—

Casein . .	3.5 lb.
Albumen . .	.7 "
Fat . . .	.5 "
Sugar . .	4.0 "
Ash . . .	.8 "
	9.5 lb.

The skim-milk thus retains almost all the casein and sugar in the new milk; but so effective are most of the modern processes of separating the cream from the milk, that only the merest traces of butter-fat may remain in the separated milk. About one-sixth of the casein and albumen consists of nitrogen, and as far as it goes, skim-milk is undoubtedly a valuable food, and may be used with great advantage in conjunction with other feeding material.

Separated or skimmed milk should not be fed largely by itself to calves, for calves so fed are liable to scour, indigestion, and other bowel-complaints. The withdrawal of the new milk should take place gradually, and other substances should be introduced in corresponding ratio to make up for the deficiencies of the separated or skimmed milk.

Artificial Food for Calves.—The other substances most largely used either in supplement of or as substitutes for milk in rearing calves are linseed, linseed-cake, oatmeal, Indian corn-meal, palm-nut meal, malt, pea-meal, barley-meal, or some specially prepared food

The characteristics and composition of these articles are described in the chapter on "Foods," which should be referred to and consulted carefully in arranging the dietary of animals.

Preparing Foods for Calves.—These articles of food are given to calves in the form of gruel, and they can hardly be too well steeped or boiled. It is desirable to have the linseed and linseed-cake ground into meal before boiling. Gruel from linseed-cake is often prepared by adding four parts of boiling-water to one part of the meal derived by grinding the cake, and allowing the mass to remain covered up for twelve hours. Palm-nut meal may be prepared in a similar manner. In making linseed-gruel, water should be added so as to give almost a gallon and a half of gruel for every pound of linseed. If the gruel is found to purge the calf, add a little more water, and for a day or two give rather less of the gruel and more of the skim-milk. A little wheat-flour, mixed with gruel, is also a useful and simple remedy in cases of purging. Mixtures of these meals are often made into gruel for calves, and the selection of the particular articles to be used will be regulated mainly by their market prices at the time.

Quantities of Milk for Calves.—In the majority of cases where calves are raised by hand-feeding, they get about two quarts of new milk twice or three times a-day—four to five or six quarts in all—during the first two, three, four, or six weeks of their existence. At these various periods, according to custom or to the supply of new milk and the other demands for it at the time, a beginning is made with the substitution of separated or skimmed milk for new milk. A very small proportion of the latter is given at first, by degrees it is increased, and soon the new milk is wholly withdrawn. Some, indeed, give new milk only for about two weeks, and others continue it for six weeks or two months, perhaps even longer. The new milk and separated or skimmed milk are given together. Some feed calves three times a-day in the first few weeks, and others only twice: it is advisable that they should be fed often.

Allowances of other Foods.—Supplementary foods should be begun soon, as soon indeed as the curtailing of the new milk has commenced. The artificial food, made into gruel, is given along with the milk, and at the outset the gruel should be given in very small quantities. Sudden changes of food may inflict serious injury upon the health of the tender young animal. Some begin to give gruel to calves before they are a month old, others delay till the animal is in its sixth or seventh week. The daily allowance of gruel will of course vary with the age of the calf, and the quantity of milk it is receiving. No fixed "bill of fare" can be prescribed with safety. The appetite of the young animals must be watched closely, and special care taken to keep the bowels in good order. Feed calves liberally, but never overdo them. Let them have just as much as they can readily consume at the time, keeping on the scrimp rather than the abundant side.

North of England Rations.—The following table of rations was long in use by an experienced breeder in the North of England for calves of the large breeds:—

1st week—4 quarts of new milk at three meals.
2nd week—4 quarts of new milk and 2 quarts boiled skim-milk at three meals.
3rd week—2 quarts of new milk and 4 quarts boiled skim-milk at two meals, and ½ lb. boiled linseed.
4th week—6 quarts boiled skim-milk and ⅔ lb. boiled linseed at two meals.
5th week—6 quarts boiled skim-milk and 1 lb. boiled linseed at two meals.

General Notes.

Feeding Calves for Veal.—A large number of calves are slaughtered for veal, and these are of course forced with rich food from the very outset. New milk is the best of all foods for this purpose, although it may be to some extent supplemented by rich gruel, made perhaps from barley-meal or Indian-corn meal. The new milk is given in three meals. The daily quantities of new milk may be a gallon and a half by the end of the first week, two and a third gallons by the end of the second week, rising gradually to three gallons by the end of the fourth week. Milk turned into veal is not likely to realise more than 6d. per gallon.

Some give raw fresh eggs to veal-calves, which are generally allowed to suck the

cow at will, or at least three times a-day.

The usual period of fattening for veal is from six to ten weeks, and with the view of improving the colour of the flesh the calves are frequently bled. In fattening veal-calves, most careful attention must be given to cleanliness, ventilation, and regularity of feeding.

Danger of gorging Calves.—Great care should be exercised in the feeding of calves in their tender days, especially during the first three weeks. At this time they should be fed sparingly rather than liberally. Many calves are lost by sucking or drinking more milk when they are quite young than their weak digestive system can readily dispose of. Whether the calf is fed by the hand or suckled by its dam, take care that it does not over-feed itself. Never let it suck or drink till it is quite satisfied—at any rate during its first three weeks. If the cow has too much milk for the calf, take away a little by the hand.

Many calves are killed by gorging with milk after a long fast—perhaps after a journey. When a purchased calf is taken to its new home it should be fed very sparingly for at least two days.

Weaning Calves.—Weaning is usually a critical event in calf-life. In dairy and ordinary stocks, where only a small portion of the milk is given to the calves, the youngsters are weaned when very young. The process may be said to begin in some cases at the end of the second week, when some skim-milk or gruel is substituted for so much of the new milk. In pure-bred herds, and wherever calves are reared largely on milk, weaning, as has been seen, is generally completed in the sixth, seventh, or eighth month.

In the weaning of calves there is scope for the exercise of the utmost skill and care. If success is to be attained, both skill and care are essential. Prepare the young animal for the weaning—the complete withdrawal of its mother's milk—by feeding it partially for some time before with such food as will form its main support after it has been weaned. Let the milk be lessened, and the other food gradually increased in quantity, so that the transition may be effected almost imperceptibly. The more carefully and intelligently this is done, the more satisfactory will be the result in the calf. The amount of milk allowed to a suckled calf may be regulated by drawing away as much of the cow's milk by hand as may be desired, and at last, just before final weaning, the calf may have access to the cow only once a-day.

There is perhaps no better food for calves at weaning-time than good linseed-cake—from 1 to 2 lb. per day, and a few sliced turnips or mangels, and fresh well-made hay. If accustomed to this fare before being entirely deprived of their mother's milk, they will be found to pass through the ordeal of weaning without any loss in condition or delay in progress.

Setoning.—A seton is a piece of string or tape passed through a certain part of the body, with the object of either drawing an abscess, or acting as a counter-irritant, or for the purpose of inoculation. As a prevention against black-leg, or quarter-ill, it is a useful custom to insert a seton in the calf's brisket in the spring. It is considered desirable to soak the seton in some irritant such as the following embrocation—viz., hartshorn, 1 ounce; turpentine, 2 ounces; spirit of camphor, 2 ounces; laudanum, ½ ounce; olive-oil, 6 ounces.

Castrating.—The male calves can be most easily castrated when a few weeks old. They can then be cut standing, by twisting the tail round one hind leg. Stand behind the calf, cut through the bag, twist the stone several times, and scrape the cord closely through with a blunt knife. When the calves are several months old they must be cast. This may be done by tying the hind legs together with a rope, placing a halter round the neck, taking the shank end of the halter and running it through the rope that unites the hind legs, tying it back, passing it through the portion that is around the neck, and drawing the legs tight, then fastening the rope. The fore legs can be held by a man. The stones may then be removed by the clams and hot iron, as in the case of the horse—place the stone in the clams, and with a red-hot iron saw the cord slowly through close to the clams.

MANAGEMENT OF STORE AND FATTENING CATTLE.

The subjects to be dealt with under this heading bulk largely in the agricultural economy of the United Kingdom. The importation of fat stock and dead meat has grown to great dimensions, yet a substantial proportion of the agricultural community of this country derive a large part of their living from the rearing and fattening of cattle. In this work, therefore, these branches of the live-stock industry demand careful attention.

PREPARATION OF FOOD FOR CATTLE.

In order to ensure the best possible results in the progress of the animals, careful attention should be given to the methods of preparing food for the different classes of cattle. In this, as in most other farming matters, it is impossible to lay down hard and fast rules which would be equally applicable to all cases. This much, however, is applicable to all—let the food be prepared and presented to the animals in as cleanly and palatable condition as possible. Depend upon it, the animals, be they mere calves or adult cattle, will amply repay in increased progress any extra care required in presenting their food to them in a cleanly, inviting, and wholesome condition.

Washing Roots.—Dirty roots should never be placed before cattle, either cut or uncut. If turnips should become very wet and muddy, they should, by some means or other, be washed before being given to cattle. Several machines have been made for washing roots, but in a brook or pond they can be washed satisfactorily by hand.

Frozen Roots.—It is very unwise to give frozen turnips to cattle. A speedy way of thawing turnips is to steep them in a pond or tank of cold water. But here, as in many other cases, prevention is better than cure. Timely storing prevents the necessity of having to use frozen roots.

Cutting Turnips.—Young cattle and sheep, with tender, imperfectly developed teeth, cannot comfortably consume uncut roots, and should never be expected to do so. Fully grown cattle can quite well eat whole roots; yet even with these it is desirable, in all cases where practicable, to have the roots cut before being given to them. The slicing is the most common method of cutting turnips for cattle. The slices, as a rule, vary from a half to three-fourths of an inch in thickness. It is bad practice to slice more turnips at one time than can be used immediately.

Turnip-cutting machines are almost innumerable, and most of them do excellent work. There are large turnip-slicers, which are driven by horse, steam, or water power; and in very many cases the old-fashioned hand-lever slicers, with some modern improvements, are still in use.

Pulping.

Where the pulping system is pursued, the roots are cut by machines into pulp or small chips, and mixed with cut straw, chaff, or other fodder, and this mixture is given to cattle either with or without the addition of crushed cake, meal, or other concentrated food, according to the class and condition of animals receiving it.

Economy of Pulping.—The pulping system economises food of all kinds, especially roots. To be sure it increases the cost of labour somewhat, but the question to determine is not merely whether pulping increases the labour bill or outlays of any kind, but whether it enables the farmer to turn his roots, straw, and chaff to better account—in short, whether it is more profitable than the older method of giving the roots by themselves whole or sliced. For the pulping system may be more costly and yet more profitable. Experience has proved it to be both in most cases; and, as would therefore be expected, it is practised extensively throughout the country. A common expression amongst farmers who have pursued the pulping system is that it

makes their roots "go a great deal further" than under the old method. Greater advantage can be derived from pulping in the rearing than in the fattening of cattle. It is also admirably adapted for sheep.

Preparing Pulped Mixtures.—The pulping process is very simple. The pulped mixture should be prepared every day, and allowed to lie from 12 to 24 hours before being given to the animals. The fermentation which takes place in this time is entirely beneficial. It softens the fodder and cake or meal, or whatever else there may be of dry food, sweetens the whole mass, and renders it not only more pleasant to the palate of the animal, but also more easily digested and assimilated than if the roots and dry food had been given separately. Never on any account allow the pulped mixture to lie so long as to become mouldy or sour.

The roots must be cut or pulped, the grain either bruised or ground into meal, the cake broken, and the straw and hay cut into chaff. For bruising and grinding grain, breaking cake, and cutting fodder into chaff, there are numerous machines of the highest efficiency.

Food-preparing Compartment.—Where pulping or any of the other modern systems of feeding are extensively pursued, it is found convenient to have a food-preparing compartment adjoining, or part of, the turnip-store. Adjoining this also, or in the same house practically, should be the cake and meal

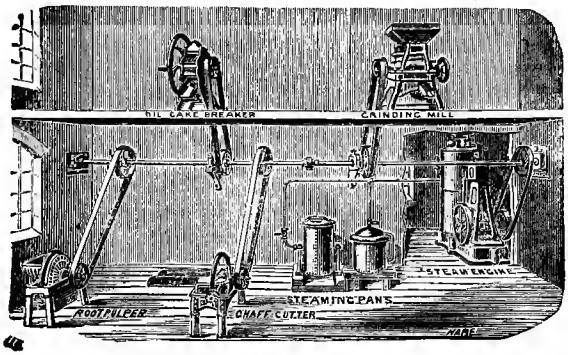


Fig. 746.—*Steam food-preparing machinery.*

compartments. A handy arrangement is to have the cake and meal stores on a floor right over the food-preparing compartment. In this floor the cake-breaker and grinding or bruising mill are situated, as also the chaff-cutter; and the broken cake, cut fodder, and bruised grain are dropped through hoppers into the apartment below, where the mixing of the food takes place.

This system is, of course, subject to many variations in detail, in accordance with the peculiarities of different steadings and the extent of the holding. The chief points to be aimed at are convenience and the saving of labour, these two terms being, in this connection mainly, but not entirely, synonymous. Fig. 746 represents one of many excellent and convenient food-preparing sets erected in farm-steadings, by Barford & Perkins, Peterborough. Provision is also made in this set for steaming the food. The small vertical engine is fixed in an outhouse or lean-to, and in addition to driving the grinding-mill, oilcake-breaker, root-pulper, and chaff-cutter, &c., it supplies steam to the two steaming-pans, one of which is used for roots, chaff, &c., and the other for boiling milk or compounds.

Cooking or Steaming.

The cooking or steaming system of preparing food for cattle has lost in favour. It was at one time practised to a considerable extent for cows and fattening cattle, but in most cases it has been abandoned wholly or partially. As a rule, food for cows receives nothing more in the way of cooking than scalding with hot water.

Bruising Grain.

The importance of having all kinds of grain bruised flat or ground into meal before being given as food to stock is now very generally acknowledged. Still, it is only too true that even yet farmers not unfrequently permit the feeding of whole grain, especially to horses. It is a wasteful practice, and should not be pursued on any account.

WINTER HOUSING OF STORE CATTLE.

The influence of locality is very great, and must be carefully considered by the successful stock-owner. In the cold regions of the north, even the young store cattle have to be housed throughout the entire winter. In the greater part of Ireland, and in the southern and milder parts of Great Britain, young growing cattle spend a good deal of the winter, when the weather is dry and favourable, on the pasture-fields. Between these two extremes of *in* all winter and *out* all or the greater part of it, there are many gradations, which individual farmers must judiciously and carefully arrange for themselves. So much depends upon local circumstances as to climate, house and field shelter, class of cattle, supply of outdoor and indoor food, &c., that to lay down hard and fast rules would be worse than useless.

Err on the Side of Shelter. — This one rule, however, one would lay down with all the emphasis and firmness that can be given to it. It is better to err on the side of caution—better to have the animals *inside when you think they might perhaps suffer little harm by being out, than outside when they would have been better in.* How often is it the case that even a reputedly careful farmer allows his cattle to remain out on the fields when he *thinks* they *might* be *as well in?* "As well in." Depend upon it, that means that the animals ought to be inside. The *thought* may or may not be expressed—when there is *thinking* in the play, be it ever so little, always let the animals have the benefit of the doubt —and the shelter too!

Fresh Air for Cattle. — Not for a moment would one depreciate the value of fresh air for cattle. Fresh air is most essential, particularly for young growing cattle. But it is easy to provide this without exposing the cattle to excessive cold, and drenching, chilling sleet, and winter rains. Cattle certainly cannot thrive well in close, stuffy, ill-ventilated houses. But while a few farmers are so careless as to let their cattle suffer in health and be retarded in progress by want of proper ventilation or fresh air, the prevailing error is entirely the other way.

Loss from Exposure to Bad Weather.—It is not in the least overstating the case to say that for every twenty shillings lost by want of ventilation in cattle-houses, there are hundreds of pounds sterling sacrificed by the exposure of cattle to inclement weather. If the value of property, in the shape of raw material for producing meat and dairy produce, which is lost every year through the imprudent and avoidable exposure of cattle to inclement weather, could be accurately stated in plain figures, the vastness of the sum would astonish everybody, no one perhaps more so than the defaulting stock-owners themselves. It would certainly run into millions of pounds sterling per annum!

For be it remembered that exposure to bad weather does more than retard the progress of cattle. It likewise incurs great waste of feeding material. While the animals are thus exposed more food is required to maintain the animal heat, not to speak of increase either in size or condition. It is a proverbial saying amongst observant if not always painstaking farmers, that cattle will thrive better upon moderate feeding with sufficient shelter, than with all the food they can eat in exposure to cold and wet.

Economical Rearing of Cattle. — The proper housing of cattle has much to do with their economical feeding. It is perhaps not overreaching the mark very far to say that the thriving of store cattle in winter is regulated almost as much by how they are housed or sheltered as by the system of feeding. This statement will suffice to show the young farmer that, if he wishes his cattle to make satisfactory progress, if he desires to secure in his store cattle the greatest possible progress, at the lowest possible

outlay of time and money, he must give as careful attention to shelter as to feeding. Unfortunately this is not always done.

In very many cases, farmers who are known to be liberal and careful feeders are lamentably negligent in providing proper shelter for the stock. More particularly does this remark apply to England and to Ireland—still more notably to those very districts in which comparatively little house or shed accommodation would supply all the shelter that is required.

Houses for Cattle in Cold Districts.—Where the winter is long and usually severe, as in the greater part of Scotland and colder parts of England and north of Ireland, substantial houses have to be provided for all kinds of cattle in winter; but where the winter is usually mild and open, very cheap erections are quite sufficient for store cattle. In cases where close houses or courts are required, care should be taken to have them well ventilated.

Cattle-sheds in Southern Districts.—Going at once from the one extreme to the other, from where the winter is severest to where it is mildest, one finds in the latter parts simple forms of winter shelter for store cattle used with satisfactory results. Very often it is a large open court, with access to a roofed compartment where the animals can take shelter from rain or snow, eat their food, and lie over night. Perhaps a roof is thrown over a portion of the court—a roof of sheet-iron or wood resting upon the wall of the court at one side and upon pillars at the other. The roofed compartment may be merely a "lean-to" on another building. It matters little how it is provided, and in these mild districts it need not be costly, substantial, or elaborate.

The main object is to make sure that there is plenty of roofed space to protect the cattle from rain, to enable them to eat their food in comfort, and have a dry warm bed. Store cattle need not be kept in such a *warm* temperature as milking cows and fattening cattle. Keep them dry and *comfortable*, and so long as *comfort* is secured, the young growing animals will be all the better of some open space to move about in when the weather is favourable.

Cattle-courts.—Between the close byre and open court and shed there are many forms of winter shelter for store cattle. The most general is the partially covered court, which is perhaps, upon the whole, the most serviceable and advantageous of all. With surrounding buildings and boundary walls the court is usually well sheltered from "a' the airts the win' can blaw"; and with a half, two-thirds, or three-fourths of it roofed, there is ample protection from rain and snow.

The equipment of houses for cattle is dealt with in vol. i. pp. 151-167.

WINTER FEEDING OF STORE CATTLE.

There are endless variations in the systems of feeding young store cattle in winter. These variations are regulated mainly by (1) the locality and methods of cropping and general farming pursued; (2) the condition and time at which the animals are to be sold; and (3) the class and character of the stock.

Apportioning Home-grown Foods.—The farmer will have to consider and arrange at the beginning of winter what proportions of his supply of home-grown winter food, such as roots, straw, hay, silage, and grain, he is to allocate to the various kinds of stock. The proper allocation of the home supply of food amongst the various kinds of stock, and the careful distribution of that supply so as to make it extend evenly throughout the entire season, are points of the very greatest importance in farm management. For instance, too free use of roots or fodder at the beginning of the winter may cut short the supply before the next grass season comes round, and the blank thus created through want of forethought may have to be filled up at disproportionate outlay by the purchase of expensive foods.

At this particular time the farmer will take special note of the quantity of roots available for the young store cattle, so that he may be able to decide and explain to the cattle-man not only what daily allowance of roots is to be given to these store cattle, but also what kinds and proportions of other food will have

to be provided for them. Probably the supply of roots available for the store cattle may decide whether or not the pulping system is to be pursued. If the supply of roots is very abundant, possibly the farmer may think it better to give the store cattle a liberal quantity of roots in the ordinary way by themselves, than to give a larger proportion of the roots to other kinds of stock or to buy in more store cattle. Circumstances alter cases; and the farmer must, at the beginning of every winter, consider carefully how he can turn the produce of his farm to the best possible account.

Economise Turnips.—Now that the turnip-break is being curtailed, it is more probable that the supply will be scrimp than abundant. In any case, it may prudently be urged as a general principle that farmers should endeavour to economise the turnip crop. It is the most costly and most risky crop in the ordinary rotation; and, all things considered, it is not by any means cheap food. As a rule, therefore, farmers should be encouraged to adopt methods which would advantageously economise the supply of roots, and render them less dependent upon the turnip-break than they have been in the past.

What Foods to be Bought and what Sold.—When it has been ascertained what quantity of roots can be had for the store cattle, the farmer will next consider what kinds and quantities of other foods are to be given to them. Whether these other foods are to be home-grown or bought, or part of both, will depend upon the supply of such home-grown foods as straw, hay, silage, and grain, and the current market prices of these and other commodities used as food for cattle. For instance, hay may be worth more in the market than as food for store cattle, so that it may be advantageous to sell hay, and — if the home supply of straw be deficient—buy oat-straw or some other food. Again, "ups" and "downs" in market prices may enable the farmer to derive profit by selling grain and buying maize, cake, or other food; or the home-grown grain may be selling so badly, and the cattle so well, that he may find it beneficial to use the grain in pushing on the live stock, instead of sending it to market.

Advantage in Using Home-grown Food.—There is a growing tendency to use more and more of the home-grown produce as food for cattle and sheep, the low range of prices of grain being the chief influence in bringing this about. Other things being equal, there is an advantage in consuming instead of selling farm produce. It is true economy to make the produce of the farm "walk itself" to market, in the bodies of well-conditioned cattle, sheep, and swine.

No Hard and Fast Rules. — Yet farmers must not be tied by rules. They should sell their farm produce, and buy food whenever it is advantageous to do so. Thus it will be seen that if the farmer is to turn his produce to the best possible account, and rear his cattle as economically and efficiently as may be, he must be able to watch the condition and tendency of market prices, as well as the quality and quantity of his own crops, with keen intelligent perception, and sound, ready, and careful judgment.

Ages of Store Cattle. — Formerly there were two generations of *store cattle* to receive attention at the beginning of winter—namely, the calves of this and those of the previous year. Latterly, however, the adoption of the "early maturity" movement, of which more anon, has advanced the calves of the previous year, now from eighteen to twenty months old, into the ranks of *fattening cattle.*

Now, therefore, the winter feeding of store cattle begins with mere calves, some of them eight or ten months old, others considerably younger. Late calves may be either sucking their dams or receiving milk in other ways at the beginning of winter; but, as a rule, the calves will have been weaned from two to several months before then, and have become well accustomed to eat such foods as grass, hay, cake, and meal.

Care in beginning Winter Feeding. —In the rearing of calves, the importance of keeping them progressing steadily from birth should be constantly kept in mind. "Never let your cattle lose the calf-flesh," is sound advice to give to farmers; and it is one which the farm-student should store up carefully in his mind. In this particular section of the work we take up the care of these young

cattle at the threshold of winter. They are, as indicated, of various ages, mostly from six to nine months, and in good thriving condition. As the supply of grass diminished and the evenings became chilly, the calves had been receiving indoor food, such as cake, meal, vetches, grass, or hay. By degrees they are worked into their winter rations. It is well to avoid sudden changes in the feeding and treatment of cattle. Give small quantities of the new food at the outset, increasing the new and lessening the old, until almost imperceptibly the complete substitution has been effected.

Turnips and Straw for Store Cattle.—In the colder districts the young store cattle, which may now be said to have emerged from calfhood, will be entirely dependent upon house-feeding by the time the winter has fairly set in. In the turnip-growing districts the food throughout the winter will consist mainly of turnips and oat-straw. Very many farmers still give the young cattle all the turnips they can eat comfortably; but, as has already been indicated sufficiently, the allowance of roots is being lessened with advantage.

Study the Animal's Appetite.—Where it is intended to feed the young store cattle solely with turnips and straw, and where there is an abundance of both, the cattle-man may decide for himself, from time to time, by carefully watching the appetite and progress of the individual animals, what quantity of each kind of food is to be given to each animal. He will be careful not to gorge the young beasts with cold roots, for in all probability some of them, of a greedier disposition than others, would eat more turnips than would be good for them. Keep within the limit of sufficiency rather than overstep it. Do not on any account give more roots at one meal than will be eaten up cleanly without delay at that time. It is a bad, wasteful practice to have roots lying for hours before cattle. Valuable food is thus destroyed, and the animals thrive best when they have their stated meals at fixed hours, getting no more roots at each time than will be at once consumed. The same remark applies to meals and cake, but with straw and hay the case is different.

Feed Sparingly and Frequently.—The long fodder is usually, and ought always to be, supplied in a rack sufficiently high to be just within easy reach of the animal's head. Many good farmers think it beneficial to have a little fodder always in the rack, so that the animals can take a mouthful when they feel the desire for it. There is something to be said for this, and the fodder in the rack is not so liable to get spoiled by the animal's breath as are roots or other food lying in a box or crib lower down. Still, it will be found more advantageous to supply the fodder sparingly and frequently than in large quantities at a time. The fresher and sweeter it is, the more keenly will it be relished by the animals; and if too much is given at a time, the cattle are apt to pull out more than they eat and waste it amongst their feet.

Feeding Hours.—The most general custom where the turnip and straw system prevails is to give the roots in two meals, one in the forenoon, between 8 and 10 o'clock, and another between 2 and 3 in the afternoon; and the fodder in three meals, between 5 and 6 in the morning, between 11 and 12 in the forenoon, and between 3 and 4 in the afternoon. In some cases a fourth meal of straw is given between 6 and 8 o'clock at night.

In many instances the daily allowance of turnips is divided into three meals, given at 6 A.M., 10 A.M., and 3 P.M.; and the young animals will be more contented and most likely thrive better with three small or moderate meals of roots than with the same quantity in two meals.

Different Kinds of Roots for Store Cattle.—At the outset, perhaps for two or three weeks, soft white turnips are given whole, "tops and all," but if the tops are very wet and muddy, they should be given very sparingly, or, better still, not at all, as in that condition they will be apt to cause scour. The white turnips are succeeded by yellows, and where a large proportion of swedes is grown, these take the place of the yellow turnips perhaps as early as the second or third week in November, probably not for several weeks later, according to the proportionate supplies of the two kinds of roots.

It is not often that the soft white turnips need to be cut; but in every instance yellow turnips and swedes should be cut for young cattle—for all kinds of cattle, indeed, whose teeth are not fully developed and in good order.

Roots, Cake, Meals, and Fodder for Store Cattle.—Partly from choice and partly from necessity store cattle are now being reared with much smaller allowances of turnips than in former times—say, prior to 1875. The advantages of this change have already been noticed. In certain cases the curtailment of the root-supply has been moderate, and little or nothing introduced in place of that withheld, excepting an increased quantity of straw or hay, and an offering of fresh pure water.

The more general plan, however, has been to give, along with the lessened allowance of roots, small quantities of other more concentrated foods, such as cake, bruised grain, or Indian corn meal, and the usual full supply of long fodder. With two small rations of roots, from 35 to 50 lb. altogether, plenty of good oat-straw or hay, and from 1½ to 3 lb. of cake or meal per day, young store cattle will be found to thrive admirably. The allowance of meal or cake is usually given early in the morning, perhaps about 6 A.M., and the roots at from 9 to 10, and about 3 P.M.; the fodder as already stated. It is considered undesirable to give a large feed of cold roots upon an empty stomach in the morning.

In other cases where still fewer roots are allowed, these are given at one time, perhaps about 10 or 11 A.M., the concentrated food being given early in the morning and afternoon, the former meal smaller than the latter. Again, in some farms the whole of the cake or meal is given in the morning, and the roots reserved till the afternoon. It cannot be said that any one plan is best for all cases; but as a rule, at any rate where the animals run out daily, it is considered most suitable to give the turnips in the forenoon.

Where the animals are able to pick up a little grass outside, they will relish a feed of cake or meal as soon as they come in, and an allowance of fodder may be reserved till later in the afternoon. Where no food is to be had outside, the animals, after a run in the fresh air and a drink of cold water, will welcome a substantial ration of oat-straw or hay.

Southern Systems of Feeding Store Cattle.—In the principal grazing districts of England and Ireland, and also in the south-west of Scotland, where the climate is mild, and the winters comparatively free from frost and snow, the young store cattle are out on the pastures almost daily throughout the winter—out many a day when they ought to be in. Where there is a good deal of rough pasture, and where care is taken to have the animals comfortably housed at night and in wet or exceptionally cold weather, the young cattle thrive wonderfully well under this system, with but very little extra food of any kind. Most likely no roots are given, perhaps nothing but long oat-straw, or a little hay or silage, once or twice a-day. In other cases a small allowance of cake or meal, from 1 to 2 lb. per day, is given.

Occasionally in these parts the extra food is given in racks and boxes outside. This, however, is not a good plan. Let the animals have it under a roof, with a dry place to stand upon, where they will have plenty of fresh air, but be free from draughts and wet.

It is not uncommon, indeed, to see turnips given to cattle on fields even in cold days in winter. In an exceptionally mild dry day there may be little harm in this, but, generally speaking, the practice is to be condemned. The animals will turn the cold roots to better account if allowed to consume them in comfortable quarters.

Pulped Food for Store Cattle.—As already indicated, the pulping system is specially serviceable in the feeding of store cattle. It enables the farmer to turn his straw and chaff to better account as food for stock than could be done otherwise. The straw of wheat and barley are not much relished by cattle when given by themselves, and cattle will not willingly eat chaff. Yet there is considerable feeding value in all these, and in a judiciously prepared pulped mixture cattle will eat them with appreciation. There is not the same advantage in pulping good oat-straw and hay, for if given in a fresh condition, and in small quantities at a time, cattle will

consume these in the long form with exceedingly little waste. But the utilisation of the less palatable kinds of fodder is an important consideration, and this, together with its great influence in economising roots, commends the pulping system very strongly as a most useful agent in the rearing of store cattle.

Proportions of Pulped Mixtures.—Already some information has been given as to the manner of preparing pulped mixtures (p. 356). The proportions of roots to other foods will, of course, depend largely upon the supply available for the store cattle. Some mix equal quantities, bushel by bushel, of pulped roots and chopped fodder; but a much smaller proportion of roots is more general. One bushel of pulped roots is often made to serve for two, three, or even more bushels of chopped fodder, and when the allowance of roots is very small, it is desirable to add to the mixture a little crushed cake, meal, or bruised grain, perhaps from 1 to 2½ lb. for each beast per day. Decorticated cotton-cake is most largely used for store cattle, but many give a mixture of this and linseed-cake or linseed-meal. The market prices should be watched carefully, and the kind of cake or other food bought which is comparatively cheapest at the time. Many careful feeders sprinkle a little common salt over the pulped mixture, and still a larger number sweeten it with dissolved treacle.

When it is intended to push the animals from their youth, and have them fattened at an exceptionally early age, the richer and more concentrated foods are increased in quantity.

Store Cattle on Pastures.

Store cattle go to the fields as soon as the grazing season begins. If the supply of pasture is fairly ample the growing cattle may get no extra food. If the pastures are poor, and if it is desired, as it ought to be, to keep the animals progressing, concentrated food of some kind should be given on the fields. The extra food may consist of whichever of the ordinary cattle foods may be cheapest at the time, and the quantities may vary from 1 to 3 or 4 lb. daily.

Keep Stock Progressing.—There is one point which demands most careful attention about the end of spring and beginning of summer. It is this—to see that the animals are carried from the one season to the other in a steadily progressing condition. Do not on any account let the animals fall off towards the end of the house-feeding season. If the supply of turnips and other home-grown food become scarce, buy in food, or reduce the stock by selling. Then if the supply of grass should be deficient at the outset, supplement with other food—with purchased corn and cake, if need be. In the period of transition from one season to another, cattle are often allowed to fall back in condition. This is very detrimental to the interests of the stock-owner, and should be avoided by hook or by crook.

Give the Pasture a Good Start.—Do not be impatient to turn the cattle from the winter quarters to the summer grazing. Let cattle of all ages remain in the steading until the grass is quite ready to receive them, and able to maintain them in a satisfactory condition. In late seasons, when the turnips and other winter food are exhausted before the grass can afford them a bite, the animals should be partly supported upon extraneous food—as oilcake, beans, oats; or those in fairly good condition should be disposed of, to leave some turnips for the young cattle and cows until the grass grows up.

The cattle are let out in relays as the grass progresses. It is a good plan at the first of the grazing season to take up the cattle at night, and give them dry fodder. This tends to counteract the laxative influence of the fresh grass.

Overgrowth of Pastures Injurious.—An important point in the successful grazing of land is to keep the pastures from growing too rank. In the earlier part of the season, in particular, they should be well eaten down, cropped frequently, but not so as to injure the plants. Pasture-grasses should never be allowed to mature and produce seed, for both the land and the plants will be thereby impaired in their productive powers. Pastures do best when grazed for about two weeks, and rested for a similar period all through the season.

All kinds of stock thrive best on moderately short pasture. Rough bunches

of grass should be regularly cut down by the scythe.

In some cases, in a good growing season, it may be advisable to buy in more stock to keep down the pasture. In other cases, especially when cattle are dear, it may be better to save a portion for hay, and thus curtail the grazing area.

On many farms the droppings of the cattle are daily collected into heaps, and in the autumn spread upon the inferior parts of the field. On others they merely scatter the droppings over the field where they are found, once or twice a-week.

Changing Stock on Pastures.—Grass-land requires skilful management if it is to yield the maximum amount of pasture in every sort of season. The circumstances under our own control which most injure grass are *overstocking* and *continual stocking*. There should be no more stock upon the farm than its grass will maintain in good condition; and the stock should not be allowed to remain too long in the same field.

The safest way to treat each grazing-field is to stock it fully at once, in order to eat it bare enough in a short time, and then to leave it unstocked for two weeks or so, that the grass may grow up to a fresh bite. One advantage of this plan is, that it provides new-grown grass; and another is, that the grass does not become foul by being constantly trodden upon. Stock delight to have fresh-grown grass; and they loathe grass which has been trampled and dunged upon, times out of number.

To facilitate the frequent changing of stock to fresh grass, many farmers run a temporary wire-fence across a pasture field, letting the animals crop first one division and then the other.

Mixed Stock on Pastures.—Another principle affecting the treatment of pasture-land is the different way in which different animals crop grass: cattle crop high, sheep nibble low, while horses bite both high and low. This is a wise distinction between the two classes of ruminants, sheep being suited to short mountain-pasture, which their mobile lips hold firmly while it is severed from the ground with the incisors of the lower jaw with a twitch of the head aside; whereas the ox is as well suited to the plains and valleys, where grass grows long, and which it crops with the scythe-like operation of its tongue and teeth.

From these different modes of cropping grass, it is inferred that the horse or sheep should follow the ox in grazing, or accompany him, but not precede him. On pasture eaten bare by horses or sheep, the ox cannot follow; and when all are in company, the horse and sheep will eat where the ox has eaten before, or the horse will top the grass before the ox, the horse being fond of seizing the tops of plants by his mobile lips, and pinching them off between the upper and lower incisors. The accompaniment of them all in the early part of the season is a good arrangement, because all have the choice of long and short grass; but the horse should be separated from the sheep in the latter part of the season, as both bite close.

Water and salt should always be within the reach of cattle on pastures.

FATTENING CATTLE IN WINTER.

In the study of the scientific aspects of cattle-feeding we have not kept pace with some other countries, yet we do know a great deal more about early maturity, and the economical production of beef, than was known in this country prior to 1870.

Early Maturity.

In the rearing and fattening of their stock the farmers of the present day are now turning both time and food to better account than their forefathers did. The progress that has been made in the matter of "early maturity"—in the rearing of stock at a more rapid rate, and fattening them in less time and at an earlier age—has been very marked and gratifying. Along with this movement—as an essential element in it, in fact—has come a great saving of cattle food. Apart from the question as to the influence which this early "forcing" of stock may exercise upon the constitutional stamina of the bovine race, in regard to which some misgivings are entertained by eminent authorities, there can be no doubt that substantial immediate benefit has resulted from it to

feeders of cattle. In feeding cattle, as in most other industries, time means money. It is important, therefore, that time as well as food should be economised. Indeed, the economical use of the one involves the thrifty use of the other, and by a careful study of these considerations farmers have raised their system of "meat manufacture" to a decidedly better footing.

Age for Fattening.—As a rule, cattle are now fattened during the second year of their existence. Large numbers are slaughtered before that year is completed, when about twenty or two-and-twenty months old. It is the exception now to find three-year-old English or Scottish bred bullocks on British farms. Many farmers practically keep on fattening their cattle from their very birth, never stinting them in food, thus not only maintaining a rapid rate of growth, but also a steady increase in the accumulation of fat and muscle.

Cheaper Meat from Young than from Old Animals.—There is no longer room for doubt that meat can be produced at a lower cost per pound on young than on old animals. To throw light on the question of the most profitable age at which to fatten animals, many interesting experiments have been carried out in this and other countries. At Rothamsted, in particular, the trials bearing on this point were numerous and instructive. In most of these trials it was found that the older and fatter an animal became the more costly it was to add additional weight of meat, confirming the American dictum of Professor Stewart that "every additional pound put upon an animal costs more than the previous pound of growth."

Lawes on High-pressure and Profitable Feeding.—Sir John Bennett Lawes was an able and persistent advocate for early maturity. He often pointed out, however, that from an economical point of view the high-pressure system of feeding might easily be overdone. He said: "Every day of an animal's life, a certain amount of food is required for sustenance purposes alone. An animal which does not increase in weight is kept at a loss, as it merely turns food into manure. On the other hand, if you require to produce as much weight of beef in one year as is produced under ordinary feeding in three years, it can only be done by a large expenditure in costly foods; and, except for show purposes, this very rapid fattening is not necessarily the most profitable. As the rate of increase is limited, however highly an animal is fed, much waste of food takes place under a high-pressure system of feeding; while on the other hand, an animal is unprofitable if it does not increase in weight every day. Between these two extremes there ought to be some point which marks the minimum cost at which a pound of beef can be produced. I have once or twice tried to construct a table for my own satisfaction, but without much success."

Methods of Fattening Cattle in Winter.

Winter is the season in which cattle-feeding is carried on to the largest extent in this country, the animals being housed for the purpose either loose in courts, boxes, or hammels, or tied up in stalls. The construction and equipment of house accommodation for cattle are dealt with in vol. i. pp. 151-167, and at this stage it would be well to consult what is said there. It is especially important that fattening cattle should be kept in a thoroughly healthy, comfortable condition, for unless this is attended to the progress of the animals will not be satisfactory.

What Food is to be Used?—It has been seen that in the methods of feeding other classes of cattle, cows, calves, and store cattle, in winter, there is almost endless variety. In the winter fattening of cattle the variation of practice is quite as great. The system of cropping and the supply of home-grown food are leading factors in determining the method of feeding pursued. The farmer should, of course, consider carefully the market price of the various recognised articles of food and of his own produce, and after due deliberation decide whether his own home-grown or purchased foods will be cheapest and most profitable. Other things being equal, he will give the preference to his home-grown food, for, as already pointed out, there is economy in making the farm produce "walk itself to market."

An important point at this time is to estimate the supply of fodder and roots,

and so apportion the daily use of these as to extend them evenly over the season.

Feeding Rations. — The fattening cattle will most likely be at various stages in their advance towards maturity. Some, already in high condition, may be intended for the Christmas markets, when winter-fed beef usually brings the maximum price. Others, most probably younger animals, will be leaner, and may require from 4 to 6 months' feeding. Both classes will be accustomed to the house-feeding before winter sets in (for all fattening animals should be housed as soon as the cold nights of September begin to be felt), and both should now be liberally fed. They should not be gorged, but have as much as they can eat, given to them at fixed intervals in as palatable and tempting a form as possible, and in such quantities as will ensure that, without any food being left or wasted, the animals will be well satisfied. As to the gross bulk, there may be little difference in the food given to the cattle, but the riper animals will get the richer food. As the cattle approach maturity, the more concentrated foods, such as cake and grain or meal, are increased, and the bulkier commodities, such as roots and straw, may be slightly lessened.

As to this variation of food, no hard and fast lines can be laid down. It would be worse than useless to attempt to do so,—it would be positively unsafe. The immediate wants, the condition, progress, and appetite, of each individual animal must be carefully considered, and in accordance with these and these alone is it safe to arrange or modify the daily meals. Thus, again, it is seen that the office of cattle-man is a responsible one. The success or failure of the feeding operations is largely dependent upon him. By careful and constant attention to the adapting of the meals to the wants and capacities of the animals, he may greatly facilitate the fattening, as well as economise valuable food.

Balancing Food properly.—As to the importance of having the foods properly balanced, a good deal has already been said. And at this critical time, when the feeder is arranging or modifying the food to suit his fattening cattle at the different stages of their progress, he may be urged to consider carefully the question of mixing foods, so that the various ingredients shall be present in the proportions most perfectly adapted to the requirements of the animal. See in particular the information given under the heading of "Animal Nutrition," p. 291 of this vol.

Scottish Feeding Customs.

On nearly all Scottish farms turnips still form a dominant or important element in the rations of feeding cattle. Yellow turnips are used at the outset, and these may last for one month, two months, or longer, as the case may be. The more advanced animals, especially those intended for the Christmas market, will receive swedes as soon as practicable, perhaps about the beginning of November. All changes in the food should be introduced gradually. In putting cattle on roots in winter, small quantities should be given at the outset, full meals being allowed only after the animals have become accustomed to the new mode of treatment.

Daily Allowance of Turnips.—What quantity of turnips should a feeding bullock receive daily? This is a vexed question, as to which opinions of practical men have undergone, and are still undergoing, considerable change. Not a few still give the animals all they can comfortably consume in two meals daily. That would perhaps mount up to, or even exceed, 120 lb., according to the size of the animal. That assuredly is improvident feeding, a more prudent and more profitable system being to give much smaller quantities of roots and larger proportions of other foods. The general tendency now is in the latter direction. The majority of the more successful feeders nowadays limit the allowance of roots to from 60 to 90 lb. per day, still less being allowed in many cases.

Feeding Hours.—The general plan is to give the turnips in two meals, about 8 or 9 A.M., and from 1.30 to 3 P.M. Some give the roots as the first meal in the morning, following with oat-straw or hay, cake or meal, or both, about 11 A.M., turnips again early in the afternoon, followed by straw or hay, and cake or meal, as in the forenoon.

Others think it better to give about

half the daily allowance of cake and meal, say at 6 A.M., to be followed about two or three hours later by turnips and oat-straw or hay; the afternoon meals coming in the same order, beginning with cake and meal at 1 P.M., and ending with straw and hay at 8 P.M. Others, again, give a very small feed of straw or hay as the first mouthful in the morning, say from 6 to 7 A.M.

Turnips or Cake for Breakfast?—Some experienced feeders contend that it is unsafe to give cattle a feed of cold watery turnips upon an empty stomach in the morning, yet many successful feeders have all their lives pursued the system of giving roots as the first meal, and say they have never discovered any evil effects from it. Upon the whole, the weight of experience is in favour of giving a small allowance of cake and meal as the first feed in the morning.

Daily Allowance of Cake and Grain.—Where the allowance of turnips is restricted to from 60 to 90 lb. per day for cattle weighing from 8 to 10 cwt. liveweight, the quantity of cake and meal may vary from 4 to 8 or 10 lb. per day, beginning the winter with the smallest, and finishing off the fattening period with the largest, quantity. The concentrated food at the outset often consists of a mixture of decorticated cotton-cake and linseed-cake, or these two and bruised oats, peas, beans, or perhaps Indian corn. Some lessen the proportion of cotton-cake and increase the quantities of linseed-cake and meal as the finishing-time approaches, the maximum allowance of concentrated food being given for a period of about six weeks at the end.

Where a still smaller quanity of turnips is allowed, perhaps 50 lb. or under per day, it is usual to give the roots either in two pulped mixtures, one in the morning and the other in the afternoon, or by themselves in one feed early in the forenoon. In either case, with this small allowance of roots, the quantities of the more concentrated foods must be increased. The necessary bulk will be made up by straw or hay; the essential nutriment mainly in cake or bruised grain.

The Pulping System for Feeding.—When the minimum quantity of turnips is allowed, the pulping system will be found specially serviceable. As already shown, it permits of greater economy of roots than can be secured by any other method. Comparatively speaking, it is perhaps more useful in rearing store stock than in fattening. The laying on of flesh and fat cannot be accomplished without the employment of a certain amount of rich food, which, of course, is as costly in a pulped mixture as by itself. But the pulping method turns the small allowance of roots to better account with fattening as well as with store cattle, and it is easy to add the required cake or grain. With mixed foods used as in the pulping system, it is easier to ensure that the ration shall be properly balanced, with all the essential constituents present in due proportion, than when turnips, cake, grain, and fodder are each given separately. It is possible, also, by careful preparation, and perhaps by a sprinkling of a little condiment or dissolved treacle, to present the pulped mixture in an exceptionally palatable and inviting condition. In the fattening of stock both these points are of much importance.

Cattle-feeding in Aberdeenshire.—The fame of Aberdeenshire beef is world-wide. In the attainment of this the people, the land, and the cattle have each played a creditable part. To reverse the order, the stock of cattle are of the very best class of beef-producing animals, chiefly crosses between the native Black Polls and the Shorthorn breed. Then the land is peculiarly adapted for the raising of turnips of the highest feeding value. It is well known that there are turnips *and turnips*, some considerably richer than others in feeding properties. The roots grown on the well-farmed granite soils of Aberdeenshire are of exceptionally rich quality. And as to the people, the knack of how to make a bullock hard-fat would seem somehow to have become the special birthright of the Aberdeenshire farmer.

Mr M'Combie's System of Feeding.—Aberdeenshire owes not a little of its reputation for cattle-feeding to the late Mr William M'Combie of Tillyfour (1805-1880), who was far in advance of his time as a feeder of cattle. His

little volume, *Cattle and Cattle-breeders*,[1] is full of useful hints to breeders and feeders of cattle. He says:—

"The practice of tying up cattle early in Aberdeenshire is now almost universal; the success of the feeder depends upon it, for a few weeks may make a difference of several pounds. I sow annually from 12 to 16 acres of tares, and about the middle of June save a portion of the new grass full of red clover, and from the 1st to the 20th of August both tares and clover are fit for the cattle. I have for many years fed from 300 to 400 cattle; and if I was not to take them up in time, I could pay no rent at all. A week's house-feeding in August, September, and October, is as good as three weeks in the dead of winter. I begin to put the cattle into the yards from the 1st to the middle of August, drafting first the largest cattle intended for the great Christmas market. This drafting gives a great relief to the grass-parks, and leaves abundance to the cattle in the fields. During the months of August, September, and October, cattle do best in the yards, the byres being too hot; but when the cold weather sets in, there is no way, where many cattle are kept, in which they will do so well as at the stall.

Tares and Clover for Fattening Cattle.—"I never give feeding cattle unripe tares; they must be three-parts ripe before being cut. I mix the tares when they are sown with a third of white peas and a third of oats. When three-parts ripe, especially the white peas, they are very good feeding. Fresh clover, given along with tares, peas, &c., forms a capital mixture. I sow a proportion of yellow Aberdeen turnips early, to succeed the tares and clover. It is indispensable for the improvement of the cattle that they receive their turnips clean, dry, and fresh.

Allowance of Cake, Corn, &c.—"I change the feeding cattle from tares and clover on to Aberdeen yellow turnips, and afterwards to swedes, if possible by the middle of October. I do not like soft turnips for feeding cattle. The cattle that I intend for the great Christmas market have at first from 2 to 4 lb. of cake a-day by the 1st of November. In a week or two I increase the cake to at least 4 lb. a-day, and give a feed of bruised oats or barley, which I continue up to the 12th or 14th of December, when they leave for the Christmas market. The cake is apportioned to the condition of the different animals, and some of the leanest cattle get the double of others which are riper."

Cattle-feeding in Easter Ross.—The district of Easter Ross has long been famous for the large number of "prime beeves" it sends to the London Christmas market. The system of feeding pursued is very liberal and carefully thought out. The majority of the cattle there fattened for the London market are put up for finishing at the end of the grazing season, when they are approaching three years old. They are well-grown cattle of first-class quality, mostly crosses between the Shorthorn and Aberdeen-Angus breeds. They are well grazed, and are in good condition when housed for hard feeding.

Mr John Gordon, Balmuchy, Fearn, one of the largest feeders in Easter Ross, states that when his feeding cattle are housed he starts them with 2 lb. decorticated cotton-cake and 2 lb. linseed-cake, gradually increasing to 3 lb. each, and then by degrees withdrawing 1 lb. of the cotton-cake and substituting a like quantity of linseed-cake. About six weeks before the animals are sent away to the London Christmas market, they get in addition to the cake 2 lb. each of bruised oats or finely ground peas or beans, very slightly moistened with water. Half the daily allowance of cake is given at 6 A.M., and a feed of cut turnips follows at 9 A.M. While the animals are eating their turnips the byres are cleaned out and the cattle groomed, and as soon as the turnips are eaten, a moderate supply of sweet oat-straw or hay is given. The cattle are then allowed perfect rest till 1 P.M., and in the afternoon they receive cake, roots, and straw or hay as in the forenoon, with a "bite" of oat-straw or hay at 8 P.M. Mr Gordon considers it of great importance to have the feeding, grooming, and cleaning done with the regularity of clock-work, and remarks that a cattleman

[1] William Blackwood & Sons, Edinburgh and London.

will never be a successful feeder unless he knows how to give a beast as much as it can eat and yet not a "pick" more. He must also watch the bowels of the animals carefully, as if an animal is purging or costive it cannot be doing well.

Anthrax and Imported Food.—In later years, with the object of lessening the risk of anthrax being conveyed to stock by the use of foreign foods, Mr Gordon has confined his choice of feeding materials to home-made linseed-cake and home-grown grain, the mixture being made up of equal portions of the following—viz., pure Aberdeen made linseed-cake, bean meal, dried distillery grains, ground wheat, ground barley, and ground oats.

A Popular Scotch "Blend."—The following mixture of foods is largely used in the Lothians and other parts of Scotland both for sheep and cattle—viz., Decorticated cotton-cake, linseed-cake, bran, maize, ground locust-beans, and peas in equal proportions, and all mixed together. When oats are cheap and maize dear, the former may take the place of the latter.

Cattle-feeding in England.

In many cases English methods of cattle-feeding differ considerably from the prevailing practice in Scotland. The warmer climate and longer period of growth provide the farmer in the south of England with greater variety of winter food than can be grown to advantage upon average Scottish farms. Comparatively fewer turnips are grown in England than in Scotland, and, as a rule, southern farmers place less reliance than northern farmers upon turnips as food for cattle. Mangels are largely grown in England, and in spring they are given freely to cattle being fattened.

In the south, cattle may, of course, in average seasons remain longer out on the pasture-fields in autumn than in the colder regions north of the Tweed, but in too many cases English farmers sustain losses by being too long in housing their feeding cattle towards the end of the grazing season. Feeding cattle should be housed overnight as soon as the chilly evenings set in; though they may have a run out daily for some time after.

Roots and Green Food for Feeding Cattle.—As indicated, a greater quantity of green food, other than roots, is grown in England than in Scotland for cattle. This is extensively used in autumn and early winter before the turnips or mangels are available. Many of the best feeders in England feed extensively upon grass-land during summer, giving large quantities of cake and meal on the fields. Any of the cattle not quite fattened on the fields are housed at the end of the grazing season, and finished upon hay, hay-chaff, a small allowance of roots, and about 6 lb. of cake, with about 2 to 4 lb. of meal per head per day.

Hereford Examples.—Farmers in the county of Hereford have been exceptionally successful in the feeding of young Hereford steers, which they turn out in admirable condition for slaughter at from 18 to 20 months old. The animals are fed liberally from their birth onwards, and in the autumn of their second year the steers get on the grass an allowance, beginning with 4 lb. daily, of cotton-cake and ground corn, wheat, barley, or oats. About the end of September they are housed, and receive the best quality of hay and pulped roots, and from 8 to 9 lb. per day of linseed-cake, cotton-cake, and bruised corn. By Christmas they are in prime condition for slaughter, and their average dead-weight would then, at from 18 to 20 months old, be about 640 lb.—*i.e.*, 8 *score* per quarter. The cake and corn is given in two feeds, the first thing in the morning and about 4 P.M.

Norfolk Systems.—In Norfolk, with the four-course system of cropping, there is little scope for grazing, but an abundance of turnips and straw. Here, therefore, roots are extensively employed in the feeding of cattle. And, as in Aberdeenshire, the turnips grown in Norfolk are credited with exceptionally high feeding qualities. Cattle, for most part animals rising two years old, are purchased in autumn, and fattened during winter in courts and yards, upon turnips, straw, hay, cake, and grain. Some farmers expend up to £5 for artificial food for each animal, this artificial food consisting chiefly of cake, with varying quantities of home-grown corn, lentils, and maize, all ground and mixed.

A Berkshire System.—Mr Chas. H. Eady, who manages the extensive home-farm of Lady Wantage at Lockinge, in Berks, says that the usual system of cattle-fattening in the stalls for ordinary market is as follows: The men begin their duties at 5.30 A.M., giving each animal—

½ bushel chaff (hay and straw).
3 lb. linseed-cake.
2 lb. barley-meal.

About 7 o'clock each animal gets about 8 lb. hay, and at midday they get ½ bushel roots (swede or mangel). The afternoon feed, commencing at 3.30 P.M., is—

½ bushel chaff.
3 lb. linseed-cake.
2 lb. barley-meal.
8 lb. hay.

Water is always before the animals.

Frequent Feeding.—In Mr R. W. Hudson's feeding-courts at Danesfield, Great Marlow, where hundreds of prime Devons are fattened annually, the principle followed is to feed little and often, the belief being that by this method better flesh is obtained and the beasts ripen quicker than by the old method of giving four meals with a munching of hay always at hand. Here is the time-table at the home farm at Danesfield as supplied by Mr Colin Campbell, the agent:—

6.30	A.M.	Cake.
7	,,	Roots and chaff.
8	,,	Hay.
10	,,	Roots.
12	,,	Meals.
2	P.M.	Cake.
4	,,	Roots and chaff.
6	,,	Hay.

The quantities vary according to the cattle being fed. All mangers are cleaned out before each meal, and every beast has water laid on before it. "Under this system," says Mr Campbell, "our bullocks put on from 1½ to 2½ lb. per day.

Mr M'Calmont's System.—At Mr M'Calmont's home farm at Crockfords, near Newmarket, a number of fine Galloway crosses are matured annually. Mr Fred C. Paine, the farm manager, states that he always feeds the roots by themselves. They mix overnight linseed-cake, bean-meal, lentil-meal, and a little cotton-cake, with sainfoin and straw-chaff in equal proportions, together with a popular sugar meal, the quantity allowed being about 3 lb. of the last-named per head daily, and 10 lb. of the mixture. This is given to the cattle early in the morning, and while eating this they are freshly littered up. About 9.30 A.M. they are allowed ¾ bushel of swedes per head (from November to the middle of February and thereafter, mangels). In the afternoon the feeding cattle receive a similar quantity of roots, the rule being to let them have as many as they will eat. The concentrated food ration is increased, as the cattle get on, to 14 lb. each, say 7 lb. linseed-cake and 7 lb. bean-meal, and 4 lb. sugar-meal extra, mixed with chaff.

Potatoes for Cattle.—In some parts of England potatoes are made use of in feeding cattle in most years, although the practice does not find universal favour. It is usual to begin with only a few pounds of potatoes, and increase gradually. They do not require to be steamed, and so long as there is no dirt adhering to them there is little danger either of choking or colic. One very successful feeder regularly turns out 50 ripe bullocks about Christmas time which are finished by the aid of the potato-crop. They will consume up to 56 lb. a-day of potatoes, but that quantity, it need hardly be said, is not recommended unless given by very skilled hands. Tubers that are slightly tainted with disease may be fed in this way. The rest of the ration consists of the usual allowances of cake, grain, and fodder.

Oatmeal Balls.—To finish a bullock well and give it that firm touch which butchers value so highly, one very successful English feeder and exhibitor pins his faith to oatmeal balls. The oatmeal is damped with water and the balls are rolled in the hand and placed before the bullock. All that is necessary is to sufficiently wet the meal to enable it to stick together.

Feeding without Roots.—For feeding cattle without roots the following plan is recommended by an experienced feeder: "One pailful of cut hay or straw three times a-day, mixed with bean-meal, Indian corn meal, linseed-cake meal, and cotton-cake meal in equal

proportions. Four to ten lb. of the meals to each beast according to size, &c. Mix the whole day's feed, chop and meal together, in a large box. Then take 1 lb. of treacle for each animal and dissolve in sufficient boiling-water; after which pour the sweetened liquor over the mixture of chop and meals in the box, and turn the whole over to let it mix thoroughly. Next cover up the feed in the box and let it stand twenty-four hours. Give a pailful three times a-day with a little salt. If the cattle have to be pushed very fast, they may get each 2 lb. daily of cotton- and linseed-cake mixed, in addition to the above feed."

Winter Feeding on Fields. — Although the system must necessarily involve a heavier consumption of feeding material to maintain the animal heat, some English farmers nevertheless derive satisfactory results by fattening cattle in dry well-sheltered fields during winter. Mr Richard Stratton, The Duffryn, Newport, Monmouth, one of the most experienced cattle-feeders in the country, says: "I give feeding cattle cake and meal on grass up to 14 lb. per head per day in winter, when they do well on dry pasture, with shelter under banks and hedges. I prefer feeding in this way to either tying up or in open yards. Straw is scarce and dear here, and the system saves litter, and prevents all waste of manure. I begin in October with about 6 lb. of cake and meal, and finish off with 12 or 14 lb. in December or January, given at 7 A.M. and 5 P.M.; the animals going away fat when from 2 years and 6 months to 2 years and 9 months old. But my practice in feeding varies according to the prices of the different commodities. Sometimes I use cake, sometimes corn; also hay or straw, according to the market prices of these. Again, as to roots, if scarce and dear, I sell them and use artificial foods; if plentiful and cheap, I consume them." Mr Stratton's farm, it should be mentioned, is in a warm locality and well sheltered.

Cattle Feeding in Ireland.

Irish farmers devote their attention to the rearing and selling of store cattle rather than to fattening. The mild open climate of their country favours this system, which is found to be more profitable and better adapted for men with limited means than finishing the cattle for the butcher. There are, however, a good many Irish farmers who fatten cattle, and most of them do it successfully.

Feeding on Pastures.

The extent to which cattle are fattened on pastures has been slowly but steadily increasing. It is now carried on to a large extent both in England and Scotland, and to a much smaller extent in Ireland. In Hereford, in particular, farmers make a special feature of the grass feeding of their famous beef-producing cattle.

Concentrated Food on Pastures.— Only in few cases, where the pasture is exceptionally rich in quality, are cattle fattened on the grass without extra food. The mixtures and quantities of extra food given to feeding cattle on pastures vary greatly according to the size, age, and condition of the cattle, the character of the pasture, the prices of the feeding-stuffs, the supply of home-grown food, and the time available for the fattening process. Cotton-cake and linseed-cake are used to a large extent, along with ground oats or barley and sometimes wheat, or some of the other foods in the market. The extra food is given in boxes on the fields twice or thrice daily. The quantities range from about 4 to 10 lb. per day.

Rock-salt and water are always within reach of the animals. Feeding cattle are put on to fresh pastures at intervals of a few weeks, the more frequently the better both for the animals and the pasture.

"Soiling."

The system of "soiling" might be humorously described as grazing cattle in the house! It consists of retaining the animals in the house, — the byre, hammel, or cattle-court, — and cutting and carting the green food to them, instead of allowing the animals to browse over the pastures and pick up the grasses for themselves.

Advantages of "Soiling."—Several advantages are claimed for this system over the older and more simple and

natural method of grazing. The chief of these are—(1) that a given extent of land will carry a heavier stocking of cattle; (2) that more actual food will be produced during the season; (3) that the quantity of food grown is more fully utilised; (4) that the animals thrive better, because they are protected from extremes of temperature, from the attentions of insects, and from undue exercise; and (5) that a greater quantity of manure is made upon the farm.

More Food Better Used.—It is unquestionable that by the frequent and systematic cutting of the grasses as they grow up, a greater weight of food will be grown during the season than when the pasture is cropped irregularly by stock in the ordinary method of grazing. Then with careful cutting and carting, every particle of the food is placed before the stock in a palatable condition, so that the material grown is more fully utilised than when it is trodden upon and unevenly eaten by cattle.

Animals Thriving Better. — Provided the animals are kept in comfortable, well-ventilated compartments, with plenty of fresh air, they will most likely give a better return for the food, in yield of milk or in accumulation of fat, than they would on the pastures exposed to sun and wind and to the torturing of insects. That young animals would develop bone and muscle more rapidly is very doubtful; but it has been abundantly proved that adult animals will accumulate fat more quickly in this confinement than upon pasture fields.

Disadvantages of "Soiling."—"Soiling" is altogether a more artificial system than ordinary grazing. It necessitates the employment of more money per acre, not only in a larger head of stock, but also in providing the necessary house accommodation, and the considerably larger force of labour. The heavy labour bill is indeed the greatest disadvantage of the system as opposed to grazing.

Then, again, there is this further consideration, that substantial outlay may be incurred in providing food to the animals in the house before the grass is sufficiently grown to admit of being cut. Successional forage crops are grown for this purpose, as well as to supplement the grass at other times. All this involves additional outlay, employing more capital per acre.

Utility of the System.—Still there are many circumstances under which the system may — especially with fattening cattle and dairy cows—be pursued with excellent results. It is specially suitable for warm climates, where forage crops may be easily grown, and where cattle would be disturbed by the excessive heat in the open fields. Then, where the supply of water for fields is insufficient, house-feeding may be followed in preference to grazing.

It is not likely, however, that in the best grazing districts, or in the colder parts, "soiling" will ever displace the long-established system of summering stock on the open fields. Indeed, it has to be noted that with all the advantages claimed for it the system of "soiling" cattle is not gaining ground in this country.

Review of Feeding Experiments.

In the *Transactions of the Highland and Agricultural Society of Scotland* for 1909 there appears an exhaustive review of the results of over two hundred experiments in the feeding of cattle conducted in this country in the seventy-six years between 1832 and 1909. The review, which was compiled for the Society by Mr Herbert Ingle, B.Sc., F.I.C., from reports appearing in various publications, is unique in its scope and character. The results are given in tabular form, showing amongst other details—

(1) The average daily ration.

(2) The rate in increase in live-weight.

(3) The quantity of digestible matter in the ration.

(4) The starch equivalent of the digestible fat, carbohydrates, amides, and fibre in the ration.

(5) The albuminoid ratio of the ration.

(6) The amount of digestible matter consumed per 1 lb. of increase in live-weight.

A striking feature in the review is the fact that the results of such a large number of experiments expressed in such definite terms as are here adopted should

be found to be so fully in accord with orthodox expectations, with what modern experience and scientific teaching would lead one to look for. Generally speaking, a survey of this exhaustive review supports the conclusion that in the feeding of their cattle the most up-to-date farmers of the present day are pursuing lines that are sound and economic both in a scientific and practical sense.

Increase in Live-weight. — The daily increase in live-weight per head averaged 1.803 lb. for 199 lots. With these 199 lots arranged in order of daily gain in steps of a quarter of a pound, the following table shows the distribution :—

Average daily gain per head.	Number of Lots.
Between 0.25 and 0.5 lb.	2
,, 0.50 ,, 0.75 ,,	5
,, 0.75 ,, 1.0 ,,	5
,, 1.0 ,, 1.25 ,,	4
,, 1.25 ,, 1.50 ,,	29
,, 1.50 ,, 1.75 ,,	39
,, 1.75 ,, 2.0 ,,	56
,, 2.0 ,, 2.25 ,,	27
,, 2.25 ,, 2.50 ,,	17
,, 2.50 ,, 2.75 ,,	8
,, 2.75 ,, 3.0 ,,	6
,, 3.0 ,, 3.25 ,,	1
	199

Digestible Matter per lb. of Increase. — The amount of digestible matter consumed for each pound of live-weight increase obtained is no doubt one of the most important measures of a system of feeding. In 199 trials the total average weight of digestible matter consumed per day per 1000 lb. of live-weight was 13.92 lb., the highest being 22.7 lb. and the lowest 7.4 lb. The weight of digestible matter consumed for each 1 lb. of live-weight increase averaged 9.00 lb. for the 199 lots. In the majority of the cases the amount was between 9 and 10 lb., more than 78 per cent being between 6 and 11 lb., and more than 50 per cent between 7 and 10 lb.

Digestible Albuminoids. — The amount of digestible albuminoids supplied per day for 1000 lb. live-weight averaged 1.675 lb. for 199 lots, the lowest being 0.11 lb., and the highest 3.68 lb. The following table shows (1) the amount of digestible albuminoids consumed per day per 1000 lb. weight by the lots in various grades, (2) the average gain per day in live-weight, and (3) the amount of digestible matter consumed for 1 lb. of live-weight increase :—

			Average gain per day in lb.	Digest. matter for 1 lb. increase.
Receiving less than	0.25 lb. per day	3 lots	0.97	13.53
,, between	0.25 and 0.5 ,,	6 ,,	1.70	7.95
,, ,,	0.50 and 0.75 ,,	9 ,,	1.69	8.92
,, ,,	0.75 and 1.0 ,,	12 ,,	1.95	8.62
,, ,,	1.0 and 1.25 ,,	20 ,,	1.80	8.72
,, ,,	1.25 and 1.50 ,,	25 ,,	1.82	8.65
,, ,,	1.50 and 1.75 ,,	28 ,,	1.72	9.60
,, ,,	1.75 and 2.0 ,,	39 ,,	1.85	9.36
,, ,,	2.0 and 2.25 ,,	19 ,,	1.86	8.29
,, ,,	2.25 and 2.50 ,,	18 ,,	1.85	8.27
,, ,,	2.50 and 2.75 ,,	12 ,,	1.93	8.38
,, ,,	2.75 and 3.0 ,,	4 ,,	2.00	8.93
,, ,,	3.0 and 3.25 ,,	3 ,,	1.57	8.90
,, above	3.25 ,,	1 lot	1.19	11.30
		199		

It will be observed that the amount of digestible albuminoids given per day was between 1.0 and 2.0 lb. in 55 per cent of the trials.

Albuminoid Ratio. — As would be expected, a wide range is exhibited in the albuminoid ratios of the rations. The average for the whole of 199 lots was 1 : 7.65, the widest being 1 : 69.5, and the narrowest 1 : 2.7.

Influence of Age on Feeding. — The particular ages at which cattle can be fattened most profitably is a matter of much interest. Some light is thrown upon this point by the following table showing the quantity of albuminoids *plus* the starch equivalent of the other food constituents consumed per 1 lb. of live-weight increase in 142 lots :—

6 months old	.	.	.	8	lots consuming	8.17	lb. for 1 lb.	increase.
12 „ „	.	.	.	14	„	8.15	„	„
18 „ „	.	.	.	11	„	8.74	„	„
2 years „	.	.	.	51	„	9.99	„	„
2½ „ „	.	.	.	18	„	8.97	„	„
3 „ „	.	.	.	38	„	8.55	„	„
4 „ „	.	.		2	„	9.80	„	„
				142				

As would be expected, the younger animals made increase with less consumption of food, but the three-year-old cattle appear to have utilised their food better than those two years old.

Leguminous Fodders. — The particulars relating to the merits of the different classes of fodders indicate that a leguminous fodder such as clover-hay is exceptionally valuable in the fattening of cattle. In 17 cases where clover-hay formed a constituent of the daily ration, the average amount of digestible matter consumed per 1 lb. of increase of live-weight was only 7.47 lb., and if two of these cases be excluded, the value becomes only 7.01 lb., while the average daily gain per head of the animals is 2.13 lb. These figures compare very favourably with the means of the whole, which are 9 lb. and 1.803 lb. respectively. This very significant result is worthy of note by cattle-feeders. The good effects of clover-hay as a constituent of a feeding ration is doubtless partly due to its high content of albuminoids, but, in the opinion of Mr Ingle, is probably also connected with the nature and amount of its ash constituents.

PREPARING CATTLE FOR SHOWS.

The following notes on the selection and preparing of cattle for showing are from the pen of Mr Robert Bruce, himself for many years an exceptionally successful breeder and exhibitor of cattle of different varieties :—

Before referring to the preparation of animals for exhibition at the principal shows, it may be well to speak of the selection of the subjects, upon which much trouble and expense have to be expended before the owner can expect to put creditable exhibits in the judging ring.

It has to be realised that in these days the competition is keener than at any former time in the history of our show system, and that there is a yearly increasing number of thoroughly capable men in charge of showyard stock, who turn out the animals under their care in the "pink of condition."

The great demand for high-class specimens of all our different breeds of cattle, which has been experienced for a considerable length of time, and the remunerative prices obtained for winning animals, have led to an increasing number of owners of pedigree herds and showyard exhibitors.

Improvement in Show Stock. — Those who can look back upon the cattle that appeared at our National shows prior to about 1870 cannot fail to realise the great changes that have taken place in the preparation and management of showyard animals, and that the average merit of showyard specimens is much higher to-day than at any former period. The very fact that such is the case has led casual critics to assert that we do not now see in our showyards the same splendid specimens which we did in former times. Opinions by the majority of such critics are formed upon comparison, and there can be no doubt but that there is now a much narrower margin of excellence between the different exhibits in a class than was the case on former times, and in consequence the winners certainly do not appear to be the same outstanding specimens they

were when the average quality of the showyard animals was of a much lower standard.

Selecting Show Stock.—Bearing in mind the competition that has now to be faced, much care ought to be devoted to the selection of the animals intended for the showyard. At the early age at which the selection has to be made, there must be in the whole matter a considerable amount of chance, and even those who may be considered experts prefer to put several of their youngsters upon the probation list before making the final selection.

Good Breeding Essential.—In making a selection, the all-important matter of breeding must receive attention and only well-bred specimens put on such a list. In using the term "well-bred" there is no intention to confine the meaning of the expression to any particular strain of blood that for the time being may be fashionable with owners of the particular breed to which the animal or animals may belong. An animal to be "well-bred" must be the produce of two good parents, and in forming an estimate of the qualifications of the parents, form, constitution, and temperament must be carefully considered.

Form and Constitution. — Without the principal points which go to make up the true form, as recognised in the different breeds, it must only be a waste of food to attempt showyard preparation; and as the life to which a subject is subjected while under training for the showyard is by no means a natural one, strength of constitution is essential.

Temperament. — Granted that form is apparent, and strength of constitution may be reckoned upon through having been inherited from the parents, the possession of a docile temperament is of much importance. No doubt the last-named qualification may be acquired, and much depends upon the man in charge if it has to be developed, but every practical breeder knows that a quiet disposition is hereditary, and is a most important factor in the selection of animals with a view to training for showyard contests.

If, therefore, three or four of the best-bred and most promising-looking calves of a breeder's lot are selected under the above conditions, we may at once proceed to consider the next step towards preparation for showyard honours.

Proper Age.—Seeing that at most of the important breeding shows the ages of animals date from the 1st January, —in some cases from 1st December—it will be at once evident that it is important the selected calves should have been born as early in the season as possible, so that when they come to be shown they may not be handicapped in the matter of age.

Calf-rearing.—The general practice pursued by the majority of breeders in the management of their pure-bred calves is to allow them to run with and suck their dams until they are eight or nine months old, having taught them in the meantime to eat cake or other concentrated foods before weaning them from the milk. In these days of keen competition a more artificial system of calf-rearing is generally pursued by successful exhibitors.

The system of calf-rearing pursued by many is to allow the calf to suck its dam for a week or ten days, when it is taken off and fed from the bucket or pail, and when it has once learned to drink it is supplied with milk long after the usual weaning age. The importance of continuing the use of milk after the animal has passed the calf stage is well understood and largely practised by showyard exhibitors. The success of such a system depends much upon the care with which the quantity given is regulated, more especially during the first two months after birth. It must be recognised that drinking the milk is unnatural, and every care must be exercised to avoid overloading the stomach and upsetting the digestive organs.

Such a system entails considerable trouble and labour, which to a great extent may be avoided by allowing the calves to suck, and in the earlier stages of their lives accustoming them to take to any nurse by frequent changes from one to the other, so that they are ready to take to any cow, and continue to suck so long as it may be considered necessary they should have milk.

A few weeks after birth calves will begin to nibble at food, and ought to receive tit-bits in the form of a handful

of sweet meadow-hay, and after a time small quantities of pulped or finely cut roots or cabbages, with a little meal or finely ground linseed-cake.

Mixed Feeding-Cakes.—This brings us to observe that there are in these days a large number of cakes on the market, many of which are prepared in a way to relieve owners of stock of much of the trouble of mixing and regulating the quantities of meals and cakes each animal ought to receive. The time was when feeders had only linseed and other seed-cakes, and had to supplement them with bran and meals given either dry, damp, or scalded. The prepared cakes referred to are sold as corn-cakes, feeding-cakes or composite cakes, and if purchased with a satisfactorily guaranteed analysis and relatively cheap, their use will be found to be labour-saving and economical in comparison with meals. As a rule, the cakes referred to have some sweetening substance in them, such as locust-beans, and are readily eaten by young animals.

Housing Calves. — The calves, whether drinking or sucking the milk, ought to be kept during the spring months in properly ventilated, well-sheltered boxes, facing south if possible, with an opportunity to spend the greater portion of the day in the open air in fine weather.

Salt and Chalk for Calves.—It is a good plan to have a lump of rock-salt and one of chalk placed in the boxes for the calves to lick when they feel inclined to do so. The benefit of salt is quite generally understood, and if chalk is also available it will be seen that it is applied to counteract acidity in the stomach, which may occur now and again, especially when milk is drunk from the pail.

Quantities of Food and Peculiarities of Animals.—No hard and fast rules can possibly be laid down regarding the amounts of the different kinds of food which ought to be given to animals at any stage of their showyard preparation, and especially during their calfhood. Nor would it be well to prescribe a ration, seeing that the most important element in the matter is the extreme necessity of attention to the individuality of the animals in training. The most successful cattle-feeders are those who thoroughly realise that every animal under their care is possessed of a distinct individuality.

Some consume much more of certain kinds of food than others, and all have their fancies, which must be attended to before a full measure of success in the attainment of early development can be expected.

Value of Showyard Honours.—In connection with this matter it is well to realise that the expense connected with showyard preparation must exceed the immediate return of profit as calculated by increase of weight for value of food consumed. Showyard honours are looked upon as advertisements for herds, and, as a rule, are indirectly profitable, although there may be a debit balance standing against the winning animals.

During the first summer the best and most promising of the youngsters on the probationary list should be kept in their boxes, while the others may join the herd and be treated in the ordinary way, being stronger and more forward than those they now join, owing to the few months' showyard preparation they have received.

During the summer months the nurse cows should be brought into the yard morning and evening to suckle the calves that are not fostered on the pail, and month by month the youngsters should get a gradually increasing quantity of linseed and other cakes, with pulped or finely cut mangolds and what fresh-cut grass they will eat. At no time at this or any period of their showyard preparation should more of any kind of food be given than will be at once cleaned up, and every capable cattleman, by careful attention to the state of the bowels, will very soon gauge the amount of the different foods that can be profitably assimilated by each animal under his care.

Exercising and Handling.—It need hardly be said that early in life the calves must be taught to lead in the hand, and during the summer months beyond the exercise they get in the yard they ought to be led out a distance of not less than half a mile each second day at least. Indeed some very successful trainers have their animals led out

as regularly every week-day as they are fed. Many prizes are lost in the show-rings through the inability of the animals to walk out with that freedom of action judges look for in high-class specimens of showyard cattle.

Attention to Animals' Feet.—In connection with this subject no amount of exercise can be of any use unless the animals' feet are attended to, and without special appliances for either slinging or throwing the animals, it is a most difficult matter to turn up the feet so that the soles can be properly dressed. If, however, while animals are quite young, they are accustomed to have their legs lifted and their feet attended to, there need be no difficulty in keeping their feet right at any period of their lives.

Grooming.—During the whole time of preparation the animals' skins ought to be kept clean and free from vermin, so that the growth of the hair may be encouraged and a healthy tone preserved. An occasional washing with one or other of the non-poisonous sheep-dips, to be followed in a few days with a thorough washing with soap and water and a cold douche, will destroy the vermin and tend to maintain the skin and hair in a healthy condition.

Increasing Food with Advancing Age.—With increasing age and greater appetite care must be exercised that the increased diet is composed of the best quality of such foods as the animals eat with relish, the quantities of each being based upon evidence deduced by observing closely the effect of any increase or change of diet on the health and digestion of the animals.

Use of Condiments.—Many animals intended for breeding purposes make their appearance in the judging rings at an early age, the large proportion of the males being exhibited at shows and sales from twelve to fifteen months old. Such being the case, early development is essential if prizes or good prices can be looked for, and however much some breeders may believe in spices and other condiments, not a few of the most successful trainers who have led many winners in the keenest of competitions have had no occasion to use such expensive materials. No doubt these condiments may be useful in the case of what are termed "shy feeders," but such animals are, as a rule, disappointing thrivers even after being pampered, and in practice it will be found that close attention to the requirements and tastes of individual animals must be looked upon as being of infinitely more importance than any dependence upon condiments.

Importance of Practical Experience.—Cattle-feeders of the present day enjoy privileges that were quite unknown in days gone by, when the values and effects of the different kinds of foods had to be found out by feeders themselves. In later times scientists have done much for the feeder, yet no amount of scientific knowledge can avail unless it be combined with a knowledge obtained by practical experience.

In much that is written upon the subject, the fact often seems to be overlooked that cattle-feeders have to do with living subjects having their own individual peculiarities, so that however scientifically a ration may be prepared, it may completely fail in producing the desired effect.

FLOCK MANAGEMENT.

The flocks of the United Kingdom form a substantial asset in its agriculture. Their numbers are large, and the enterprising and skilful manner in which they are managed reflects credit upon their owners. In the breeding, rearing, and feeding of sheep in this country there have been just as marked advances in recent times as in the management of our herds of cattle.

In another part of this volume (pp. 138-206) the many valuable breeds of sheep kept in the United Kingdom are fully described, and so also are the

methods of management pursued in pure-bred flocks. In view of the fulness of that information, the details to be given here regarding the rearing and feeding of ordinary sheep stocks need not be extended to great length.

LAMBING SEASON.

With the owners of breeding flocks the lambing season is a busy and anxious time. The results of the year's operations depend largely upon how the flock fares at this season. It is therefore of the utmost importance that the most careful attention should be given to the treatment of the ewes and their offspring in the tender days of the latter. These matters, as already indicated, are dealt with so fully in the section relating to flocks of the pure breeds that little need be added here. In their main features, the systems of management suitable for the lambing season in pure-bred flocks are equally well adapted for that period in ordinary mixed-bred flocks. The attentions of the shepherd should be just as thorough and careful in the one case as in the other.

Lambing-Pens. — On many farms there are elaborate and costly lambing sheds and pens built of stone and lime. On others the lambing-pens are merely temporary erections, formed, perhaps, of hurdles and straw; while in many cases no lambing-pens of any kind are provided. Costly erections are not necessary, but lambing-sheds or lambing-pens of one kind or other should be provided upon all farms carrying breeding-sheep, and for all kinds of sheep, whether the hardy mountain breeds or the more tender southern varieties. Little roofed space may suffice, but there should be a dry bed and shelter from the prevailing winds to make it unnecessary to put any of the ewes and lambs under roof, yet the means of doing so should exist. The sudden occurrence of a storm without proper shelter being at hand for ewes with very young or tender lambs might result in serious losses.

Hardiness of Hill Sheep.—Hill sheep are not as a rule brought into lambing-pens as is done with lowland breeds. They produce their young on the hillsides, and in average seasons the death-rate amongst hill lambs is wonderfully small. The vitality of these creatures when newly dropped is quite marvellous. Still, it is desirable that, even for the hardy hill sheep, some provision should be made whereby the more weakly lambs may have shelter in excessively wet cold weather. For this purpose, it will be found useful to have some artificial shelter provided at suitable points throughout the farms. Little huts constructed perhaps of turf, hurdles, and bundles of straw or rushes, will entail little outlay or trouble in formation, and during inclement weather will be found of great benefit to the ewes and lambs. Ewes with weakly lambs can be accommodated comfortably in these scattered huts for a few days and nights, the shepherd carrying or having conveyed to them some hay, corn, and roots.

Lambing Hospital.—A few pens in a corner of the lambing-fold by themselves should always be set apart for hospital purposes. They may be formed of hurdles and straw at very little trouble and expense, and would be of great benefit wherever a breeding flock is kept.

Supplementary Shelter. — In addition to the regular lambing-fold it would be well to provide additional shelter in the form of small covered pens or huts at convenient well-sheltered parts of the farm, for weakly ewes and lambs during a storm.

Shepherd's Hut.—It is advisable to have a sleeping-place or shelter for the shepherd beside the lambing-fold. It may be a fixed structure or may rest on wheels and be made of iron or wood.

In many cases shepherds are provided with medicine-chests furnished with a considerable variety of medicines and stimulants, comprising laudanum, linseed-oil, castor-oil, spirits of nitre, Epsom salts, powdered ginger, powdered chalk, tincture of aconite, carbolic acid, Gallipoli oil, and whisky or brandy, &c.

Assistance in Lambing.—As a rule, experienced shepherds are very expert and successful in assisting ewes in lambing. Young shepherds do not acquire the skill and deftness required for this service from books, but from practice in association with older men, and it is the

duty of all shepherds to equip themselves thoroughly for the work as early as practicable. Before giving assistance to a ewe while lambing, the shepherd should smear his hands as well as the vagina of the ewe with "carbolic oil"—that is, a mixture of 1 part of carbolic acid to 10 parts of pure olive-oil; and a little of this germ-killer should also be smeared on the broken umbilical cord at the navel, especially if the weather is wet and the land slushy.

The exact moment for rendering assistance can be known only by experience. It is necessary to watch and wait, for a hasty parturition often superinduces inflammation, if not of the womb, of the external parts of the ewe.

Inflammation after Lambing.—Unless the utmost care is exercised there is great risk of losing the ewe after a case of hard labour, by "bearing" or "straining"—after-pains—and inflammation. Formerly the rate of mortality from inflammation after lambing was often high, but it has been abundantly proved that by timely treatment the danger may be effectually averted. It has already been pointed out that in all cases the shepherd, before assisting a ewe, should smear his hand in a mixture of carbolic acid and olive or Gallipoli oil—about 1 part of the former to 10 parts of the latter. Then, after the removal of the lamb, about two tablespoonfuls of the carbolic acid and oil should be injected into the womb, while any of the external parts which seem inflamed should be smeared with the same mixture. This treatment should be repeated every three or four hours, as may be found necessary. The strength of the carbolic mixture should be regulated—from 10 to 20 parts of Gallipoli oil to 1 of carbolic acid—according to the symptoms of the case. The handiest instrument for this purpose, and one which has proved itself invaluable in the lambing-fold, is made by fixing a 6- or 7-inch injection-tube suitable for a female into an indiarubber enema-tube bulb. It is portable and convenient, forcing the germ-killing fluid into all the recesses of the inflamed womb.

Where the symptoms of inflammation are serious, a strong mixture should be applied promptly and frequently.

It should be mentioned that the credit of discovering this invaluable preventive belongs to Mr Charles Scott, author of *The Practice of Sheep Farming*.

Assisting Lambs in Feeding.—When lambs do not succeed at once in finding the teat, the shepherd should give assistance, and if the supply of milk should not be sufficient the shepherd may have to partly feed the lamb on cow's milk. For this purpose he should have with him a supply of fresh cow's milk every day.

Cow's Milk for Lambs.—Caution is required in beginning a young lamb upon cow's milk. At the outset it should be given in small allowances and often. It is best when given immediately it is drawn from the cow, but if it has been allowed to cool it may be raised to its natural heat by being placed in a cup upon the kitchen-range for a moment, or by a clean hot iron being inserted in the milk.

Removing Ewes and Lambs.—Ewes are kept on the lambing-ground until they have recovered from the effects of lambing, the lambs have become strong, and the ewes and lambs are well acquainted with each other. The time required for all this depends on the nature of the lambing and the state of the weather. When quite recovered, the ewes, with their lambs, are put into a field of new grass, where the milk will flush upon the ewes, much to the advantage of the lambs.

Mothering Lambs.—When ewes and lambs are turned out to pasture, or out of the lambing-fold, the shepherd ought for the first ten days to see, at least twice a-day, that every lamb is with its own mother, and especially in the case of twins, to see that they are both having regular access to the right ewe. Distinctive marks with paint on ewes and lambs are helpful in this work of *mothering*.

Much trouble is imposed upon shepherds when ewes will not take their own lambs; but this does not often happen. Another duty which requires tactful conduct on the part of the shepherd is the introducing of a strange lamb to a ewe that may have lost her own lamb. But by patience and kindness difficulties are usually got over.

Stimulants for Weak Lambs.—When a lamb has become so prostrate as to necessitate removal from the mother, it should not only be placed upon a woollen cloth near a moderate fire, but have a little stimulant administered as well. Some experienced shepherds recommend from a half to a whole teaspoonful of gin or whisky in a little warm water, sweetened with moist sugar; a very little of its mother's milk—or the milk of another newly-lambed ewe, if its own mother is not alive—should also be given without delay. The ewe should be milked into a small jug or cup, and the milk at once conveyed to the lamb, which may be fed by a teaspoon. If the milk gets cold before being given to the lamb, it should be heated to the normal temperature by the addition of a few drops of hot water, or, better still, by a clean hot piece of iron inserted into it.

Carrying Lambs. — Young lambs should be handled as little as possible. When they have to be carried, this should be done by the two fore-legs. Never seize or carry a lamb by the body.

Cleaning Ewes' Udders.—Any loose wool should always be removed from the udders of ewes at lambing, so as to prevent the lamb from swallowing pieces of wool, and forming hair-balls in the stomach. These balls often prove fatal to lambs. They are sometimes formed by lambs on bare and dirty pasture where pieces of wool are lying about.

The Lambing Period. — It may at first thought seem curious that within the narrow limits of the British Isles there should be such a length of time as there is between the dates of lambing in the earliest and the latest districts. The lambing period in this country actually extends over six months, beginning with Dorset sheep in the extreme south of England in November, and ending with mountain sheep in the north of Scotland in the month of May.

After Lambing.

Lambing in a flock is usually completed in four or five weeks. The after-treatment of the flock varies in accordance with the class of sheep, and the objects in view.

Castration.—The male lambs not to be kept as rams are castrated when from ten days to five weeks old. In some cases, indeed, castration is performed when the lambs are only two or three days old, but the more general plan is to delay from two to four weeks.

In hill stocks castration is not usually performed until the lambs are fully a month old; in other words, the ewes commence to lamb in the third week in April, and the "marking" takes place about the end of May, varying a little according to circumstances and local custom. Some farmers have a decided objection against too early castration, as it tends to give a feminine appearance to the wedders, stunting the growth of horn, and weakening the neck too much.

Great caution is required in castrating lambs. It should not be done in rainy, cold, or frosty weather; nor should the lambs be heated by being driven before the operation. They should be caught and handled gently. One assistant should catch the lambs, and another hold them while the shepherd operates.

There are different methods of castrating. One method is to make two slight incisions, one for each testicle; another, to cut off the point of the scrotum and pull both testicles through this large opening — the testicles in both cases being pulled out by the shepherd's teeth. The amputated wound takes a considerable time to heal, whereas the two simple incisions heal by the first intention. It is argued, however, by those who prefer the latter plan, that there is an advantage in the larger opening, as all discharges are more readily got rid of.

Docking.—Advantage is taken of the opportunity afforded at castration to dock the tail, which in Scotland is left as long as to reach the meeting of the hams. In docking, the division should be made with a large sharp knife in a joint, when the wound will soon heal. The lamb, after being docked, is let down to the ground by the tail, which has the effect of adjusting the parts in connection with the castration. Ewe lambs are also docked at this time, but they are not held up, being merely caught and held by the shepherd between his legs until the amputation is done.

In England, docking is performed at the third joint, which gives a stumpy

appearance to the tail. The object of docking is to keep the sheep clean behind from filth and vermin; but as the tail is a protection against cold in winter, it should not be docked so short in Scotland as is done in England. Tup lambs, in order to strengthen the backbone, are allowed to retain their full tails until one year old.

Risks from Castration and Docking.—The scrotum does not bleed in castration, but the tail often bleeds in docking for some time in two minute and forcible streams, though usually the bleeding soon ceases. Should it continue as long as to sicken the lamb, a small cord should be tied firmly round the end of the tail, but not allowed to remain on above twenty-four hours, as the ligatured point would die by stoppage of the circulation of the blood, and slough off. In some instances inflammation ensues, and the scrotum swells, and even suppurates, when the wound should be carefully examined and the matter discharged.

To avoid irritation to the wounded scrotum, the new-cut lambs should for a few days be put on old grass or new grass, where the stubble is specially short.

A Preventive.—Some farmers use a mixture of pure olive-oil and spirit of turpentine for dropping into the scrotum after extracting the testicles, and the results they claim are satisfactory. Perhaps a still better preventive of inflammation would be a few drops of a solution of carbolic acid and oil poured into the scrotum. The knives used in castrating should be dipped into a disinfecting solution now and again, to keep them clean and free from disease germs.

Rig or Chaser.—Sometimes one of the testicles does not descend into the scrotum, when the lamb ultimately becomes what is called a rig or chaser—one which constantly follows and torments the females of the flock, when near him. It is not, as a rule, safe to rely upon such a ram for breeding.

Look to the Pastures.—The state of the new grass-fields occupied by ewes and lambs requires consideration. Ewes bite very close to the ground, and eat constantly as long as the lambs are with them; and as they are put on the new grass in spring, before vegetation is much advanced, they soon render the pasture bare in the most favourable circumstances, and especially so when the weather is unfavourable to vegetation. In cold weather, in spring, bitten grass soon becomes brown. Whenever the pasture is seen to fail, the ewes should be removed to another field. But in removing ewes and lambs from a short to a full bite of grass, caution is required in choosing the proper time for the removal. It should be done in dry weather, and in the afternoon.

Shepherding on Arable Farms.—On low country or arable farms with the softer breeds of sheep, from 200 to 300 ewes are about as many as one shepherd can superintend during the day; and it may be necessary to have an assistant for him in the night, to gather the ewes into shelter at nightfall, and to take a weakly lamb, or all the lambs that have dropped during the night, into sheds erected on purpose, or into sheltered stells, as a protection against bad weather. To ascertain the state of his flock, he should go through them with a lantern at least every two hours, and oftener if necessary.

Shepherding Hill Sheep.—The hardy breeds of hill sheep need less attention, especially during the night. Indeed, the general plan is to leave the flock undisturbed during the dead of the night. The ewes and lambs are turned out to the dry lair over-night, and there the shepherd looks over them carefully, perhaps as late as eleven o'clock, while he or his substitute returns to them as early as 3 or 4 A.M., when daylight is making its appearance.

Ailments among Lambs.—Young lambs, as long as they are dependent on their mother for food, are subject to few diseases. A change to new luxuriant grass in damp weather may bring on the *skit* or diarrhœa, and exposure to cold may produce the same effect. As long as the lamb feeds and plays, there is little danger; but should it appear dull, its eyes watery and heavy, and its joints somewhat stiff, remedial means should immediately be used. In the first place, it is usual to give a gentle aperient, say, half an ounce of Epsom salts, with half a drachm of ginger, and this may be followed by a tablespoonful of sheep's

cordial, consisting of equal parts of brandy and sweet spirits of nitre.

Ailments amongst Ewes. — After recovery from lambing, the complaint the ewe is most subject to is inflammation in the udder, or *udder-clap* or *garget*. The shepherd must give careful attention to this, and apply the usual remedies where required. Directions for the treatment of ailments amongst live stock are given at the end of this volume.

Abortion among Ewes.

Ewes in lamb are liable to abortion, or slipping of the lamb, as it is termed, as well as cows, but not to so great an extent, nor does the complaint so often become epidemic in its character. It is known, however, that there is a form of abortion amongst ewes which is caused by a specific germ (see p. 337 of this volume). Various other causes produce abortion amongst ewes, such as severe weather in winter, having to endure much fatigue in snow, leaping ditches, being frightened by dogs, over-driving, feeding on unripe watery turnips, &c.

Unripe Roots and Abortion.—The clearest evidence as to the evil influence of exclusive feeding of in-lamb ewes upon unripe watery roots was obtained by Professor Axe in the season 1882-1883. The turnip crop in that season was unusually abundant, and, owing to the mild winter of 1882-1883, continued to grow, and remained throughout the season in an unripe and exceptionally watery condition. Of the total number of ewes (about 7800) fed exclusively on roots, no fewer than 19 per cent aborted; while, where the roots were supplemented by frequent changes to grass, the rate of abortion fell to 3 per cent, and to 1¼ per cent where the roots were supplemented by corn and cake, or some other substantial aliment.

In reference to the high-pressure system of forcing the growth of roots by the free application of artificial manures, and the growing practice of sowing roots late and beginning their consumption early, Professor Axe remarks that these are inconsistent with full maturation and ripening of roots, and that on this account "the desirability of a guarded and judicious employment of this description of food in the management of breeding stock cannot be too forcibly insisted upon."

He also very strongly objects to the "too common system which condemns pregnant ewes to live exclusively on filth-laden shells" behind other sheep, which get the best of the fresh roots.

Foot-rot and Abortion. — It was shown clearly that foot-rot contributed largely to the cases of abortion. In flocks where it prevailed to any extent the rate of abortion was 4½ per cent greater than in those in which there was no foot-rot.

Twins and Abortion.—The cases of abortion were much more numerous with twin than with single lambs. Indeed, for every abortion with a single lamb there were six abortions with twin-lambs —pointing, as Professor Axe says, "to the existence of some debilitating cause unfitting the ewes with twins to meet the greater demands on their nutritive resources, while influencing in a less degree those with singles."

Preventive Measures.—The following preventive measures are recommended by Professor Axe:—

"1. That from the time ewes are placed on turnips to the time when they lamb down, they should receive a liberal amount of dry food, to be regulated according to the nature of the season and the condition of the roots.

"2. The quantity of roots should at all times be limited, and besides shells, a fresh break should be given every day after the hoar-frost has disappeared, and in the early spring the tops should be removed.

"3. Change from the fold to the open pasture twice or thrice a-week, or for a few hours each day, if convenient, is desirable, and especially when the lair is bad.

"4. Protection from cold winds and driving rains should be provided in stormy weather.

"5. Plenty of trough-room should be provided, and ample space allowed for the ewes to fall back.

"6. All troughs should be shifted daily, and set well apart.

"7. Dry food should be given at the same time as the fresh break of roots, to prevent crowding at the troughs.

"8. Rock-salt should be at all times accessible.

"9. Animals suffering from foot-rot, or other forms of lameness, should be removed from the fold, and placed on dry litter, and receive such other attention as the nature of the case may indicate."[1]

SHEEP IN SUMMER AND AUTUMN.

The summer is the season of least anxiety with flock-owners and their shepherds. Unless abnormally unfavourable weather should be experienced the duties of shepherds in the summer months are not likely to be arduous, yet the really efficient shepherds keep a constant and careful watch over the flocks in their charge throughout the whole year.

Ewes and Lambs.

The treatment of ewes and lambs during summer varies greatly, according to the locality and character of the grazing, the class of sheep, and the ends in view with the lambs and their mothers.

In ordinary unpedigreed flocks, where the ewes are to be kept for further breeding, and the lambs for breeding or for fattening later on, they graze together till weaning time, no extra food being given in ordinary circumstances. Where ewes and lambs are to be fattened for slaughter in the course of the summer or autumn, extra food is allowed all through the season, as is usually the case in pure-bred flocks where the youngsters are intended largely for breeding purposes.

For information regarding methods of feeding ewes and lambs where grazing alone is not relied upon, the reader is referred to the section in this volume dealing with pure-bred sheep, pp. 138-205. The methods of treating ewes and lambs pursued in all parts of the country are so fully stated in those pages that further details here would be mere repetition.

[1] *Jour. Roy. Agric. Soc. of Eng.*, vol. xxi. (1885), p. 199.

Pasturing Sheep on Arable Farms.

The method of pasturing sheep on arable land is regulated according to the class of stock kept and the nature and management of the farm. The stock may be a breeding or "flying" (hogging) one, or a certain modification of either, or both these recognised classes. A ewe stock is generally found where the farm is largely under rotation grasses or permanent pasture. The hogging system, on the other hand, prevails where the farm is worked in rotation, and the soil adapted for turnip culture.

Summer Fattening.—Sheep intended to be fattened on the pastures during summer are usually graded in lots, according to the conveniences on the farm in the way of separate fields. And it is a matter of great importance on grazing farms to have a good many fields of small or moderate size, rather than fewer fields of greater area. Of the sheep to be fattened a draw of the best is made, and these are put into the best piece of pasture. With plenty of good sweet pasture, and perhaps a little cake and grain, they will now fatten rapidly. Bruised oats are much in favour for fattening sheep on pasture.

Store Sheep in Summer.—The sheep to be kept simply in good store condition during summer are of course treated less sumptuously than the fattening sheep. A common plan with a flock of hoggs is to select the leanest and smallest, and assign these to the best of the pasture available for the store sheep, so that upon this (and perhaps a little extra food in the shape of oats) they may so develop as to "match" more evenly with the "tops" at the time of selling.

Shifting Sheep on Pastures.—When sheep are enclosed on fields, it is very desirable that they should be frequently shifted on to fresh pasture. The change will be beneficial both for the sheep and the pasture. It will be all the better for the sheep if the changes can be arranged from poorer to richer food. Where the fields are large they should be divided, perhaps by a temporary fence of wire or iron hurdles.

Water for Sheep.—There is a prevailing idea amongst many farmers that there is little or no necessity to provide

water for sheep on pasture. This is a serious mistake, which is responsible for greater losses to flock-owners than would be readily imagined, especially when feeding on cake or other concentrated foods is practised. On succulent pasture with heavy dews sheep may require no further supply of water; but in dry weather and on dry pasture they cannot thrive and maintain good health without access to water.

Salt for Sheep.—Salt is especially necessary for sheep. It gives tone to the system, and should always be within their reach. Common salt may be given to them in partially covered boxes on the fields, or rock-salt may be put within their reach.

Maggot-fly.—During warm weather the shepherd should have his eye upon every sheep on the farm at least twice a-day. At this time they are liable to be attacked by the "maggot-fly." If any animal is seen to be restless, twisting its body, shaking its tail, and running forwards with its head bent down, the shepherd should catch it, and most likely on close examination he will find a colony of maggots located about the hind parts. In hot weather the shepherd should never go to the fields without having in his pocket a bottle of dip-mixture or fly-oil. With this he anoints the part attacked, and shakes out the maggots from the wool. This simple treatment will be quite sufficient.

Unclipped Sheep Falling.—Long-woolled sheep, hoggs especially, before being clipped, are so loaded with wool that, when annoyed by the ked, they are apt to roll upon their backs; and when that happens they are sometimes unable to get up again. They lie *awkward* or *awald*, and would soon die. Shepherds have to watch carefully to guard against deaths from this mishap.

Many collie dogs are quick in observing sheep in this state, and some will run and take hold of the wool, and pull the sheep over on its feet. Shepherds cannot be too alert in visiting sheep on pasture at this season.

Pasturing Sheep on Hill-farms.

The system of management pursued on hill-farms in carrying flocks from spring until weaning-time is usually very simple.

Stocking on Hill-farms.—The classes of sheep kept on hill-farms are arranged to suit the character of the land, the nature of the pasture, the altitude and exposure of the farm. A common plan is to maintain a stock of ewes on the low ground attached to hill-farms, or where the heath is well mixed with green ground, or interspersed by streamlets with green banks. Young sheep are placed on ground similar in character, but with a less admixture of green pasture. Older sheep generally occupy the higher grounds.

Pasture Plants on Hilly Ground.—The intelligent shepherd observes carefully the different kinds and succession of pasture plants suitable for the feeding of sheep, and as these attain sufficient growth he gives his flock a turn upon them. For instance, in most parts during January and February, "mossing" is usually plentiful; in April and May, "deerhair" becomes a standard plant; in June, July, and August, green banks, "haughs," and old pasture land are at their best; in September and October, "prie" and "stool bent" come up; and in November and December, "moss leek" and coarse bent and heath come in for use.

There is thus upon hill-farms, embracing high and low ground, a wonderfully complete succession of pasture plants. It is the object of the careful shepherd to take advantage of these as they come up in turn; and the flock-owner's balance-sheet may be largely influenced by the manner in which these successional growths are observed and utilised.

Heather-burning.

As heath constitutes a large ingredient in the food of mountain sheep, it is important that heath-burning should be carried out systematically, so as to have at all times a succession of young and old heath. Sheep-farmers have long been in the habit of burning a portion of the heath on their farms every year, with the view of allowing it to grow again, that its young shoots may support sheep in those parts of the grazing where there is little grass. Burning causes an abundant growth of young shoots; it is therefore the interest of both landlord and tenant that the heath should be so burned as

to produce the greatest growth of young shoots.

Methods of Burning.—Various methods of heather-burning are pursued. The best plan is to burn in regular rotation, so that every piece of heather on the farm be burned at intervals of about eight years or less.

The burning of heather is controlled by the regulations of the property, and is usually carried out at the sight of and with the assistance of the gamekeeper and his gillies, the shepherd helping and pointing out the most suitable parts. Heather takes about three years before it sprouts after burning, but often on the burned ground other plants come up soon which are useful to sheep.

Sheep-washing.

There has from time to time been much discussion as to the utility of washing sheep before clipping them.

Objects in Washing.—There is a two-fold object in washing sheep—to free the wool from earthy material and improve its lustre, and cleanse the skin of the sheep from incrusted matter.

Opposition to Washing.—It is maintained by many flockmasters that any depreciation in the price per pound for unwashed wool is fully compensated by the greater weight of the fleece, and that the advantage to be derived from having the skin of the sheep cleaned by washing may be more than counterbalanced by the risk and trouble of the after-washing. It is better, they think, that the cleaning of the wool should be left to the manufacturer.

Washing is pursued to a large extent in some districts, chiefly where the sheep are kept on arable land, and in others hardly any washing takes place. Perhaps about a third of the sheep stock may be washed.

Study the Market.—The best guide as to the expediency of washing sheep will be the tendency of the wool trade—whether washed or unwashed wool finds the greater favour, or brings relatively the higher price. The advantages from washing are, as a rule, relatively greater when prices of wool are high than when they are low. The loss of weight by washing will most likely be from 1 to 2 lb. per fleece, and washed wool will usually bring from 1½d. to 3d. per lb. more than unwashed wool. The cost of washing would be from 1d. to 1½d. per head.

Methods of Washing.—There are different methods of washing sheep. It is most frequently done in a pool about 3 feet deep, formed in a small stream; but where a stream does not exist it may be done in a natural pond or at the side of a lake. A pool with a muddy bottom is not suitable. It is important to have grass-land on both sides of the pool.

The sheep to be washed are enclosed on one side of the pool, the animals being one by one pushed or drawn into the water and made to go out at the other side. For a day or more after washing the sheep should be kept on the cleanest grass-land available, where there are no bare earthy banks.

In small flocks washing is sometimes carried out in large tin baths.

Time of Washing.—Washing takes place about eight or ten days before clipping.

Lambs are very rarely washed.

Shearing of Sheep.

This is an interesting event on sheep-farms. In most parts the sheep-shearing is regarded as a joyous occasion—a sort of harvest—in which a liberal allowance of beef and broth and ale is dispensed to the clippers engaged in the laborious work. It is a point of great importance to have dry settled weather for this operation; and as the time approaches, flock-owners watch the weather indications with some anxiety.

Time of Shearing.—The exact time of shearing varies with the locality, the class of sheep, and the season. The clipping season may be said to extend from the middle of May till the end of July. The new growth of wool should be well started before the clipping begins.

If the sheep have been washed, they may be clipped about eight or ten days thereafter.

The tups are first shorn, then the hoggs and wethers, and lastly the ewes.

On Lowland and mixed husbandry farms a covered place is generally selected for clipping. Upon large sheep-farms

facilities are provided for clipping at the sorting-pens, where there is often shed accommodation.

In case of dew or rain in the morning, as many dry sheep may be brought into the barn on the previous evening as the number of clippers will shear on the ensuing day.

Force at Clipping.—It is customary for neighbouring sheep-farmers to assist

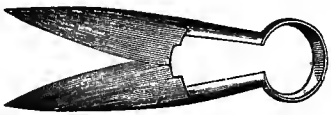


Fig. 747.—*Wool-shears.*

each other in clipping. The emulation amongst a number of men clipping together not only expedites the shearing of the individual flock, but makes the work cheerful, and calls forth the best and quickest specimens of workmanship from each clipper. Many additional hands have to be hired or transferred from other farm-work for the occasion, the number required varying with the size of the flock.

Wool-shears. — The tool with which the wool is clipped off sheep is made of steel, in the form of *shears*, whose broad blades are connected by an elastic ring (fig. 747).

Avoiding Injury to the Sheep.— Shearers who are expert and careful scarcely ever injure sheep in clipping, but when the skin does get cut with the shears the wound should be at once dressed with tar. It is important in clipping to keep the *points of the shears clear of the skin*, which may be done by gently pressing the blades upon the body of the sheep.

Methods of Clipping. — There are various methods of clipping sheep. The process is intricate, and can be learned only by practice. Many clippers, women as well as men, become very expert at the work, and will clip from 25 to 30 sheep per day, some of them even more.

Shearing Lambs.—In the extreme south of England, the practice of clipping lambs has long been pursued. It is by degrees spreading northwards, and is considered by many flock-owners to be decidedly beneficial to the progress of the lambs. In the case of lambs which are to be fattened off in the course of their first winter or following spring, it is specially advantageous to clip them as lambs. Lambs' wool is usually in request at a comparatively high price. It is generally past midsummer before lambs are shorn.

Sheep-shearing Machines. — The shearing of sheep by mechanical appliances is now carried out successfully, and to a large extent, especially on the great sheep-ranges of the colonies. There are several excellent shearing machines in use, all of them working on the principle of the horse-clipper. The first of them was the "Wolseley," brought out in Australia in the closing quarter of the nineteenth century. In many cases hand-power is sufficient, but steam, oil, and other engines are used where the flocks are very large. A

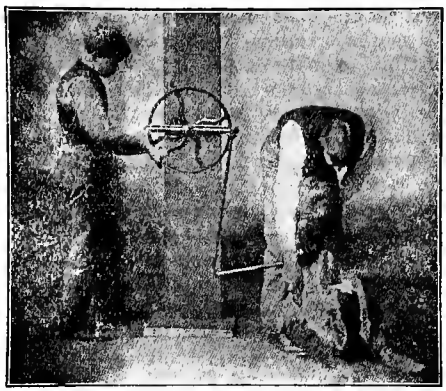


Fig. 748.—*Hand-power sheep-shearer.*

hand-power single clipper (Stewart's), fixed to a post, is shown in fig. 748.

Storing Wool.—As they are taken from the sheep the fleeces are carefully assorted, freed from lumps of dung, straws, thorns, or other rubbish, and rolled up for storing. In some cases the fleeces are immediately put into large canvas sacks or pack-sheets, but, as a rule, this is not done till the time of delivery to the buyer. On large farms a wool-room is provided, but in many cases the wool is stored in a granary or outhouse. The wool should be kept dry and cool, and out of the reach of dust light, and moths.

Weaning Lambs.

The time of the year for the weaning of lambs, like that of the lambing itself, is subject to great variation throughout the country. June, July, and August are the weaning months, southern arable farms coming first, and northern hill-farms last. In some cases in the south weaning takes place as early as May.

In many cases hill lambs are not now weaned. Those to be sold are sent to the marts directly they are taken from the ewes, and the lambs to be retained longer in the flock are allowed to remain with their mothers. This system is harder upon the ewes, but the gain to the young stock is substantial. It is believed that lambs allowed thus to remain with their mothers are less liable to "braxy" in the autumn months than lambs weaned in the ordinary way.

Treatment of Ewes and Lambs.—As to the treatment of ewes and lambs at the weaning time, information is given in the portions of this volume dealing with the management of pure-bred flocks. Nothing further need be said on the matter here beyond urging the importance of the shepherd watching carefully lest any ewe should suffer from a persistent supply of milk. If ewes after weaning are removed to close-eaten dry pasture, there will, as a rule, be little danger; but in extreme cases it may be advisable to relieve the udder by drawing away a little milk by hand, taking care not to empty, but merely to slacken, the udder.

After-treatment of Lambs.—The treatment in the way of feeding given to the lambs after weaning depends mainly upon the purpose for which the youngsters are designed. If they are to be fattened off early on the farm, or sold to others for this purpose, they are fed highly all along. The lambs to be kept for breeding purposes or for fattening at a later time are treated more moderately. The systems pursued in the different parts of the country in the rearing of lambs after weaning are indicated in the description of the management of pure-bred flocks in an earlier part of this volume.

Fattening Lambs.—The rate at which the lambs are forced will, of course, be regulated to suit the time at which it is desired to have them ready for slaughter. In Hampshire and other parts in the south of England, where the fattening of lambs for slaughter at nine to eleven months old is extensively pursued, the system of feeding is most liberal and highly forcing. Until early turnips are ready, the youngsters have frequent changes—perhaps weekly—upon rich pasture, lucerne, and clover aftermath, with all they can well consume of cake and grain. Then on turnips they have artificial food and hay.

The raising of fat lambs for early slaughter is pursued extensively, especially in the south of England, and in these cases both ewes and lambs are fed highly. Lambs being fattened after weaning get ample supplies of highly forcing food, as is shown in the feeding of Hampshire lambs at p. 173 of this volume.

Drafting Lambs.—After weaning the lambs are drafted, so that the various classes may be assigned to the intended purposes. Most probably the stronger of the wether lambs and the greater number (the best) of the ewe lambs will be retained to run on the farm along with the old sheep until later in the season. The others may be sent to arable farms to be wintered on grass and turnips. Those kept behind are drafted to the low country, as the pasture becomes scarce on the high ground, and as the winter approaches.

Marking Sheep.

Sheep are marked for the purposes of identification and classification, in various ways and at different times. There are the farm or flock mark, the age mark, and the pedigree or breeding mark. To provide these, five distinct systems of marking are in use—ear-mark, tar-mark, keel-mark, horn-brand, and tatooing letters and figures in the ears. (A convenient system of ear-marking is shown in fig. 704, p. 167, in this volume.)

Tar should be used sparingly in marking the fleece, so as to avoid as far as possible injuring the selling value of the wool.

Registering Marks.—To facilitate the recovery of strayed sheep, the flock-masters in several counties and districts register their respective marks, and publish these in book or pamphlet form. This is an excellent plan, especially useful in large pastoral districts where there is little fencing.

Dipping Sheep.

In order to protect them from insect attacks, and to generally promote their health and comfort, sheep are dipped, or dressed in some other way, once or twice a-year. With the view of getting rid of "scab," stringent Dipping Orders have been introduced by the Board of Agriculture. These vary from time to time, and it is of the utmost importance that flock-owners and their shepherds should make themselves familiar with all changes in the Orders as they appear.

Former Customs.—Formerly it was the custom to "bathe" the sheep on lowland and arable farms, while the sheep on hill-farms were "smeared." The latter method was preferred for high-lying farms, because "smearing" tends to keep sheep warmer in exposed parts, and to render them less liable to be affected by changes in the weather.

Bathing and smearing have both to a very large extent given place to "dipping," yet it will be useful to indicate briefly how these older methods were carried out.

Bathing.—For bathing, or "pouring" as it was sometimes called, the utensils

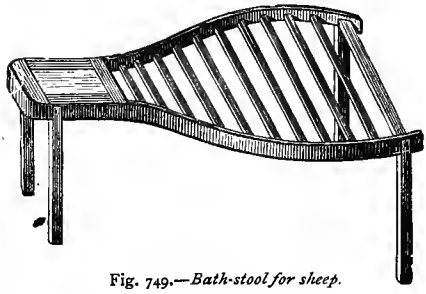


Fig. 749.—*Bath-stool for sheep.*

required are,—a bathing-stool, such as is shown in fig. 749; a bath-jug or a tin bottle with a pipe passed through the cork, and a tub or other vessel to hold the bathing mixture.

The sheep is placed on its belly on the stool, with its legs passed through the rungs, the head being towards the shepherd, who sits on the end of the stool. The shepherd with his thumbs and forefingers sheds the wool along the centre of the back from the head to the tail, and opens the shed with the palms of his hands. A boy then pours the liquid from the tin or jug along the shed, following the shepherd's hands, from the tail to the head of the sheep. Other sheds are made, about 3 inches apart, until the whole animal is covered, and from these sheds the liquid bathes the entire skin of the sheep.

Smearing.—Smearing is done in a manner similar to bathing, although the materials used are different. The smearing mixture consists of tar and butter, made up in such proportion as to be sufficiently consistent to be readily lifted on the finger of the operator. It is applied in the sheds of the wool by the shepherd himself, who takes from the kit or tub beside him a portion of the mixture with his forefinger, and rubs it into the shed. The sheds are made closer than for bathing, perhaps an inch or an inch and a quarter apart. The entire body is thus gone over, so that the sheep becomes enveloped in a close matted covering of wool, tar, and butter.

Dipping.

This is the most expeditious and now almost the universal method of dressing sheep.

Process of Dipping.—The operation of dipping is simple in the extreme. The sheep are either plunged or made to swim through a specially prepared tub, bath, or tank, containing the dipping liquid, after which they are kept on a drainer until the liquid ceases dripping from their fleeces.

The chief recommendations of dipping, therefore, are cheapness, efficiency, and remarkable despatch.

Construction of Dipping-bath.

Dipping-baths of many different patterns are in use throughout the country. Some are small and movable, others large and permanently fixed.

Swimming-bath.—For large flocks

the modern swimming-bath is the most convenient. Directions as to the construction and working of a bath of this kind are given in an admirable treatise on *Sheep-Dipping* by the late Mr David Wood. Flock-owners would find it useful to refer to this pamphlet.[1]

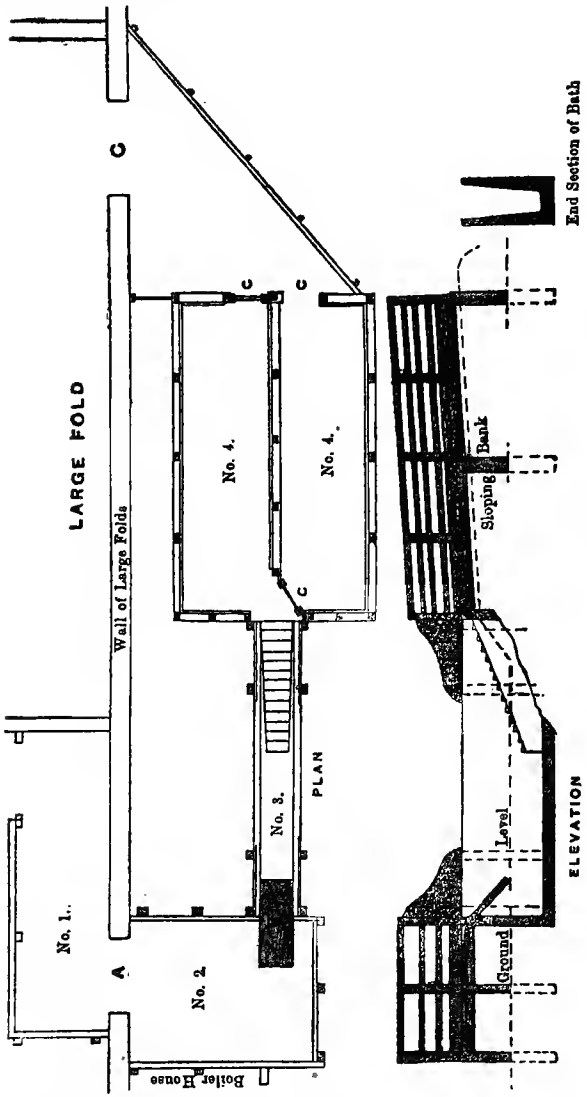


Fig. 750.—*Dipping-bath.*

Process of Dipping.—The process of dipping in this bath is thus described by Mr Wood: "All being ready for starting, we will suppose a good number has to be dipped: two persons will be needed to bring the sheep forward; two, or, better still, three should stand at the side of the bath, to guide the sheep through. Let the one nearest the catching or entrance pen take hold of each sheep with one hand as it comes forward and as it walks down the sloping board, and with the other hand press down the hinder part of the sheep, keeping the head above the mixture. It will be found when the sheep has a good coat of wool upon it, that considerable pressure is needed to get it down, but it is of great advantage to do so. Let the sheep then be passed on to the next assistant, and so on until it gets foothold up the sloping gangway."

Plans of Bath.—The bath described by Mr Wood is represented in fig. 750, which shows a bath erected at Bailliemore Farm, Strachur, Argyllshire. The sheep enter the catching or gathering pens at No. 1, which is formed inside one large division of fold; through gateway A pass into No. 2; through gateway B, thence into the bath, No. 3, passing up into the dripper, No. 4. When drained, they pass out of the upper end of dripper back into a second division of large fold through gateway C. Pens Nos. 1 and 2 will hold about as many sheep as both divisions of dripper 4, 4. The boiler-house is built so as to take advantage of

[1] W. Blackwood & Sons. Price 1s.

wall of large fold, one side of it forming a side of pen No. 2.

Cost of Bath.—The cost of erecting this bath, exclusive of the boiler-house, and allowing nothing for the carting or the timber, which was grown on the estate, amounted to only about £10.

Stone and Wood Baths.—The main plan of the bath and dipper described by Mr Wood is well suited for swimming-baths of all sizes; but later experience has shown that it is easier for both sheep and shepherd to have the bath deeper set in the ground, so that the top is level with the surface, and a space for standing in made about 3½ feet deep at each side of the dipper. Different materials are used in the construction of dipping-baths. Wood is largely employed; but the best kind of material is the Caithness flagstone—that is, where it or any similar flagstones can be obtained conveniently, and at reasonable cost.

Tossing Sheep into Bath.—The construction of the passage leading into the bath, so as to facilitate the driving of the sheep into the latter, requires consideration. The sheep are of course reluctant to walk into the liquid. It is a good plan to let the floor of the passage terminate in a trap-board, which capsizing forwards, tosses the sheep into the bath in true bathing attitude.

Some farmers consider that the catching or "gripping" pen may be advantageously dispensed with—a short passage or "shedder" being formed between the gathering-pen and the bath. The best method of regulating the passage of the sheep is by hanging a small gate just inside the trap-board, and keeping a lad in charge of it. By adopting this method the services of the "grippers" are unnecessary, and the rough handling the sheep might otherwise experience is avoided.

In some of the modern patent dippers there are ingenious trap-door arrangements, by which, one at a time, the sheep are sunk gently into the bath, being thus dipped without any shock.

Plunge-bath.—For small flocks the small plunge-bath is still most largely used. It is generally constructed of wood or flagstone, and the sheep have to be lifted both into and out of it.

Dipping Mixtures.

The flock-owner has almost unlimited choice as to the material to be used in bathing or dipping his sheep. Prepared sheep-dips are in the market by the score. To say that they are all good would be saying too much. There are at least a dozen, however, which are extensively employed, and each of which is cordially commended by different flock-owners. A certificate is given by the Board of Agriculture for those dips which are found efficient for the cure of scab, when used according to directions.

Non-poisonous Dips.—These dips are roughly classified into poisonous and non-poisonous dips, those which contain poisonous ingredients and those which do not. It is believed, however, that some of the so-called non-poisonous dips are such only in name. Indeed it is affirmed by many farmers that perfectly non-poisonous dips would be ineffectual in destroying keds and other insects unless used at greater strength than directed by their makers. Non-poisonous dips will kill the insects, but not the embryo or eggs. These develop later; and for this reason, those who use non-poisonous dips have to dip twice in order to thoroughly cleanse their sheep. The interval between the two dippings usually extends to ten days or a fortnight.

Composition of Dips.—Non-poisonous dips are, as a rule, made up of carbolic acid in one form or other; an alkali soft soap, with sometimes a slight addition of sulphur. The poisonous dips are in most cases supplied in the form of powder, and are usually made up of arsenic and alkali, soda, or potash, occasionally with the addition of sulphur. Some farmers prepare their own dips, but it is generally safer to use a well-tried manufactured dip.

Time for Dipping.—The most general time for dipping is towards the end of autumn and beginning of winter. It is a common practice to dip lambs when they are weaned, and some repeat the operation about November. In some cases the summer dipping is deferred, and the ewes and lambs dipped together about two weeks before tupping begins. A few dip immediately after clipping. In other cases the dipping of adult

sheep is deferred until the New Year, or even until spring, the practice varying with the locality, the liability of the sheep to be struck by the fly, and the prevalence of other parasites. In arranging the times of dipping, farmers must conform to the Orders of the Board of Agriculture.

Weather for Dipping.—It is very essential that dry weather be chosen for the operation, otherwise little benefit will be derived from it. If the sheep are wet the wool will not absorb the dip properly; and if after dipping they are exposed to heavy rain, before the fleece has become perfectly dry, the solution will in all probability be washed out of it.

Dressing for Scab.—When scab appears in a flock the matter must be reported to the Local Authority, who will see that certain dipping and isolating operations are duly carried out.

Tupping Season.

The autumn and early winter is the mating season on sheep-farms, the precise time for introducing the rams to the ewes varying considerably throughout the country.

Flushing Ewes.—It has been found a good plan to "flush" the ewes just before tupping—that is, to give them an exceptionally abundant supply of succulent food for about two weeks before tupping, so as to have them in an improving condition when mated. This treatment hastens tupping, tends to increase the number of twin-lambs and to lessen the number of barren ewes.

If possible, a portion of rich pasture should be preserved for this purpose, or the ewes may have a run of the new grass and stubbles after harvest. On some farms where pasture is not available, a small breadth of rape is grown for the ewes, and in other cases a moderate feed of bruised oats is allowed.

On hill-farms farmers are not so anxious for twin-lambs, for on these lands one good lamb is usually sufficient for a ewe to rear satisfactorily. Hill-farmers, therefore, give less attention than lowland farmers to "flushing" the ewes. Still, many save low pasture upon which to feed the ewes two or three weeks before tupping.

Some flock-owners, however, question the propriety of flushing stock ewes, as they believe that when a big crop of lambs has been got one season by "flushing," the crop of lambs in the following season may be smaller, no matter how much the ewes may be flushed—a view, however, that is not universally held. "Flushing" no doubt can be overdone. Ill effects of severe flushing with such succulent food as mustard may be modified by letting the ewes have mainly dry food between tupping and lambing.

Fertility in Sheep.—An important inquiry into the effects of "flushing" and other factors supposed to influence fertility in sheep was conducted for the Highland and Agricultural Society of Scotland by Dr F. H. A. Marshall in the years 1905, 1906, and 1907. This inquiry confirmed the view that extra feeding at about tupping time results in a larger crop of lambs at the subsequent lambing. In Dr Marshall's report on this inquiry,[1] reference is made to other special causes believed to affect fertility in sheep. Inclement weather during tupping time may lessen the number of twins. It is believed that fertility may be developed by tupping early instead of late in the tupping season, the generative system being most active at the beginning of the season. It seems well established that fertility is a property that can be inherited, and thus it is believed that systematic breeding from twins will tend to increase fertility.

Management in Tupping Season.—The various important matters requiring attention in connection with the tupping season—such as the mating of ewes and tups adapted to each other, the treatment of tups, adjusting the number of ewes to each tup, and observing and recording service—are dealt with fully in the details of management in pure-bred flocks given in an earlier portion of this volume.

SHEEP IN WINTER.

The management of sheep in the winter months demands the utmost care. The system of winter treatment varies greatly,

[1] *Trans. High. and Agric. Soc. of Scotland*, fifth ser., vol. xxii., 1908.

perhaps even more than the treatment in the other seasons. Naturally the anxiety amongst sheep-farmers and shepherds as to the wellbeing of their flocks is greatest in the coldest and stormiest parts, where vast expense and trouble are often involved in carrying flocks safely through severe snowstorms.

SHEEP ON TURNIPS IN WINTER.

The practice of keeping sheep on turnips in winter is pursued largely throughout the country. For the most part the sheep are folded on the roots on the fields where grown, though in some cases the roots are pulled and given to the sheep on pasture or in sheds.

Preparing Turnips for Sheep.—As to methods of preparing unpulled turnips for consumption on the ground by sheep, information is given in vol. ii. pp. 357 and 358. It is important that this work should be carried out in good time and with care, so that the most economical results may be obtained.

Enclosing Sheep on Turnips.—There are two ways of enclosing sheep upon turnips—with *hurdles* made of iron or wood, and with *nets* made of twine or wire. Since the introduction of nets, the older method of enclosing with wooden hurdles has become exceptional, and is now seldom adopted unless where the enclosure is to stand for a considerable time, or for temporary enclosures for sorting sheep. Iron hurdles used for enclosing sheep are referred to in vol. i., figs. 119, 120, and 121. The wooden hurdles in use are of various patterns, a specially good light hurdle being that shown in fig. 751. It is formed of any sort of willow or hardwood, as oak-copse, ash-saplings, or hazel. The erecting of hurdles is a simple process which need not be described.

Nets for Enclosing Sheep.—Nets, made of twine of the requisite strength, form a superior enclosure for sheep when supported on stakes driven into the ground. The *stakes* are best formed of thinnings of trees, and they should be seasoned with the bark on before being cut into stakes. The stakes are usually about 3 inches in diameter and 4 feet 9 inches long—allowing 9 inches of a hold in the ground, 3 inches between the ground and the bottom of the net, and 3 inches from the top of the net to the top of the stake. They are pointed at one end with the axe, and that end should be the lower one when growing as a tree, as the bark is then in the most natural position for repelling rain.

Setting Sheep-nets.—If the ground is in a soft state, the stakes may simply be driven into the ground with a mallet, the stakes being placed from 2½ to 3 paces asunder. Should the soil be thin and the subsoil hard, a hole sufficiently large for a stake may be made in the subsoil with the tramp-pick used in draining or an iron piercer made for the purpose. The stakes are driven in until their tops may not be less than 4 feet high, along as many sides of the enclosure as are required at the place to form a complete fence.

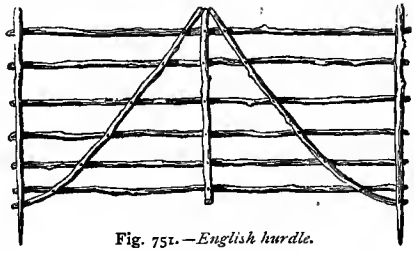


Fig. 751.—*English hurdle.*

The net is set in this manner: Being in a bundle, having been rolled up when not required, the spare ends of the top and bottom ropes, after the stake is run through the outer mesh of the net, are tied to the top and bottom of a stake driven close to the fence, and the net is run out loose in hand towards the right as far as it will extend on the side of the stakes next the turnips. On coming back to the second stake from the fence, with your face to the turnips, the bottom rope first gets a turn to the left round the stake, then the top rope a similar turn round the same stake, so as to keep the meshes of the net straight. The bottom rope is then fastened with the shepherd's knot to this stake, 3 inches from the ground, and the top rope with a similar knot near the top of the stake, adjusting the net along and upwards; and so on, with one stake after another, until the

whole net is *set up*, care being taken to have the top of the net parallel with the surface of the ground throughout its entire length.

Shepherd's Knot.—The shepherd's knot is made in this way: Let *a*, fig. 752, be the continuation of the rope fastened to the first stake; then, standing on the opposite side of the stake from the net, press the second stake with the left hand towards *a*, and at the same time tighten the turn of the rope round the stake with the right hand by taking a hold of the loose end of the rope *d*, and putting it between *a* and the stake at *c*, twist it tight round the stake till it comes to *b*, where it is pulled up under *a*, as seen at *b*, and there its elastic force will secure it tight when the stake is let go. The bottom rope is fastened first, to keep the net at the proper distance from the ground, and then the top rope is fastened to the same stake in the same manner, at the width the net admits, at stake after stake. If both the cord and stake are dry, the knot may slip as soon as made; but the part of the stake at *b* where the knot is fastened on being wetted, the rope will keep its hold until the cord has acquired the set of the knot. It is difficult to make a new greasy rope retain its hold on a smooth stake even with the assistance of water, but a double turn round the stake will ensure its staying secure.

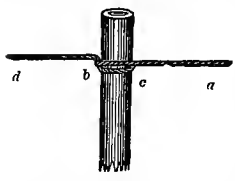


Fig. 752.—*Shepherd's knot, in fastening a net to a stake.*

The shepherd should be provided with net-twine to mend any holes that may break out in the nets.

Wire Nets.—In certain situations, where rabbits and hares are apt to destroy string nets, or where it is not necessary to step over the nets with cut turnips or other food, wire has largely taken the place of twine nets. Wire nets are made with meshes of any size, but 4 inch is the size generally in use, and 3 feet is the most common height. Twine nets are made to set about 40 yards, but wire nets set 10 yards farther. The cheapest are made by machinery, with the wire running practically horizontally, but the best are made only by hand, with the wire worked from top to bottom and *vice versâ* backwards and forwards. The top and bottom strands are extra strong, and one or two strong strands are worked along the centre. Iron or steel wire is used, and galvanised after manufacture, giving a strong, enduring, and convenient fence at a minimum cost. In setting up, the stobs are first erected as for twine nets, and the end of the wire net unrolled and fixed to the first stob, then the whole roll of netting is unrolled alongside the stobs, pulled tight, and the far end fixed to a stob. After this it is an easy and rapid process to fix to the stobs by twine, or preferably by bell-hangers' staples, from which the net is unhooked and rehooked as required when taking down and re-erecting. Sometimes the stobs are driven through the meshes of the net and tied firmly with twine, but this plan is severe on the net.

Extent of Roots given at a time.—Care has to be exercised as to the quantity of turnips made available for sheep in an enclosure at one time. After a week or so, breaks which will serve a couple of days, or three at most, may be given, but this will altogether depend on the weather.

In frosty weather or snow, turnips sufficient for the day only should be given, otherwise the shells will become hard frozen in a very short time, and the sheep are unable to eat them, so that when a thaw sets in these rot. A good plan is to allow the sheep to work on the ground given during the forenoon, and set pickers on in the afternoon, to pick up all the shells for the sheep, no more ground being given than will serve the sheep for the day.

Carting Turnips to Lea Land in Wet Weather.—When the weather becomes excessively wet, and the sheep cannot comfortably consume the roots upon the black earth, the turnips, after being tailed, may be carted from the field and spread on pasture, and the sheep taken from the turnip-breaks until better weather sets in.

Another plan, sometimes adopted in wet weather, is to leave the sheep on the turnip-field only from early morning till about 3 P.M., the rest of the time

being spent on pasture, where extra food may be given in boxes. In other cases the turnips are pulped, and given to the sheep on pasture.

Begin Turnip-feeding Early.—The turnip-break should be made ready for the sheep before the grass fails, so that the feeding sheep may not lose any of the condition they have acquired on grass; for it should be borne in mind that it is easier for animals to progress in fattening than to regain lost condition. Much rather leave pastures in a rough state than lose condition in sheep for want of turnips. Rough pasture will never be wasted, but will be serviceable in winter to ewes in lamb and to aged tups. Feeding sheep, therefore, should be put on turnips as early as will maintain the condition they have acquired on grass.

Begin cautiously with Turnips.—It is considered advisable to avoid putting sheep on turnips for the first time in the early part of the day when they are hungry. Danger may be apprehended from luxuriant tops at all times, but when they are wetted by rain, snow, or half-melted rime, they are sure to do harm. The afternoon, when the sheep are full of grass, should be chosen to put them first on turnips; and although they will immediately commence eating the tops, they will not be likely to hurt themselves. But it is a still safer plan to begin by carting cabbage or turnips, a few at a time, to the grass-field, than to put the sheep straight from grass to turnips.

Turnips risky for Ewes.—Sheep for turnips are selected for the purpose. Ewes being at this season with young, are not often put on turnips in the early part of the winter, but continue to occupy the pastures, part of which should be left on purpose for them in a good state, to support them as long as the ground is free of snow. As the lambing-time approaches, and the pastures begin to get bare, a few turnips are often given daily to in-lamb ewes, generally on a pasture-field, and along with a little hay and cake. But care should be taken never to give frozen roots to in-lamb ewes, as this has often been blamed for causing abortion. Many farmers also altogether avoid giving turnips to in-lamb ewes, in the belief that they are liable to cause inflammation at lambing.

Draft Ewes on Turnips. — Every year a certain number of old ewes, unfit for further breeding, from want of teeth or a supply of milk, are drafted out of the flock to make room for young females, and are fattened upon turnips, with the addition of a little corn or cake and hay.

Young Sheep on Turnips.—It sometimes happens that the hoggs—the castrated male lambs of last year and the ewe lambs not required for breeding,—instead of being sold, have been grazed during the summer, and are fattened on turnips. In many parts of the country lambs are now freely fed on turnips.

Turnip-tops for Sheep.—Care should be taken not to shift the sheep or give them a fresh break when the turnip-tops are covered with white or hoar frost, as numbers of deaths happen from this cause. In fact, farmers put too much value on turnip-tops: if hoggs, fat sheep, or other feeding animals were never to taste them, they would fatten faster. If the tops are cut off a day or two before the fold is shifted, and scattered over the ground, they wither before the hoggs get at them, and loss is avoided.

A supply of stored turnips should always be at hand to give to the sheep in case of hard frost.

Dry Food with Turnips.

When sheep are on turnips, they should always be supplied with dry fodder, hay or straw,—that is, where they cannot have a daily run of some rough dry pasture. Clover-hay is the best and most nutritious, but fresh oat-straw answers the purpose very well. The best way of supplying dry food is to chaff the hay or straw and place it in the boxes which are required for the cut turnips later in the season. About ¼ lb. oats per sheep per day, mixed with the chaff, gives excellent results; many of the sheep will become ready for the butcher without further feeding.

South of Scotland Methods.—In the midland and south-eastern counties of Scotland, the fattening of sheep is carried on to a large extent, the moderately dry climate in these parts being favourable for this industry. The sheep

are begun on the soft varieties, and are passed on to yellows and swedes in turn. Great numbers of hoggs are fattened in this way. Many are given ample allowances of turnips, just about as much as they can eat without waste. In addition, they get mixtures of oats, decorticated cotton-cake, and other materials, varying from ¼ lb. to 1 lb. or more per head per day, with hay and straw. Linseed-cake, beans, peas, maize, bran, brewers' and distillers' grains, and condimental foods, are all used to a lesser or greater extent.

Sheep-Fodder Racks. — Fodder for sheep is largely given in racks, which are of various forms. A strong and useful fodder-rack for sheep, fit for grass or tares in summer, or turnips in winter, is shown in fig. 753. It was invented by

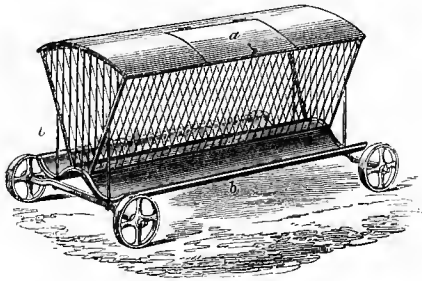


Fig. 753.—*Kirkwood's wire sheep-fodder rack.*

Rack of wirework 6 feet long, 2 feet 9 inches wide at top, 8 inches wide at bottom, and 2 feet 3½ inches deep.
a Curved cover of sheet-iron with a hatch.
b b Sheet-iron troughs to contain corn, &c.

Mr Kirkwood of Tranent. The troughs are provided with a hole at each end to allow the rain to drain off, and might be used in dry weather for holding salt or oilcake for the day.

Another very useful rack, made by Mr W. Elder, Berwick-on-Tweed, is shown in fig. 754. It is made chiefly of wood and wire, and is useful also as affording shelter.

Substitutes for Feeding-Racks.— Another plan often adopted by farmers is to hang a net on a double row of stakes, the middle of the net forming a receptacle for the hay. Wire-netting with mesh of about 4 inch, set double along a row of stobs, has also been found a cheap and durable means of giving hay to sheep.

Supplying Fodder. — Two racks or more are required, according to the number of sheep. It is the shepherd's duty to fill them with fodder, which is easily done by carrying a small bundle of fodder every time he visits the sheep. When carts are removing turnips from the field, they carry out the bundles.

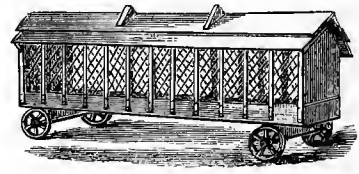


Fig. 754.—*Elder's sheep-fodder rack.*

If only as a means of providing shelter, irrespective of fodder, the racks should be kept full. Fodder is consumed more at one time than another; in keen sharp weather the sheep eat it greedily, and when turnips are frozen they have recourse to it. In rainy or soft muggy weather it is eaten with little relish; but it has been observed that sheep eat it steadily and late, and seek shelter near the racks, prior to a storm; while in fine weather they select a lair in the open part of the break.

Fig. 755 is a simple and convenient form of trough for oats or other feeding-stuffs. A convenient length is 9 feet, its form acute at the bottom. An excellent sheep feeding-box is shown in fig. 706, vol. iii. p. 169.

Picking out Turnip-shells.—Until of late years, sheep helped themselves to turnips, and when the bulbs were scooped out to the level of the ground,

Fig. 755.—*Trough for turnip sheep-feeding.*

their *shells* were raised with a *picker*, the mode of using which is seen in fig. 756. By this mode of action the tap-root of the turnip is cut through and the shell separated from the ground at one stroke.

Only half the ground occupied by shells should be picked up at once, so that the sheep may take up a larger space of ground while consuming them. When the ground is dry, the shells should, on the score of economy, be

nearly eaten up before a new break of turnips is given; and if any shells are left, the sheep will come over the ground again and eat them.

Cutting Turnips for Sheep. — The feeding of sheep on uncut turnips can be satisfactorily carried out until their teeth become defective: this occurs from the constant eating of hard roots, often in a semi-frozen state, which loosens the front teeth. The farmer can readily judge when other measures become necessary by the appearance of the bulbs, which have their outer skin peeled off by the sheep, and so left.

To meet this difficulty the turnip-cutter comes into requisition. Many thoroughly efficient machines are now available for this purpose, such as that

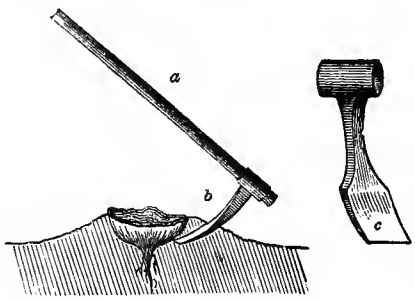


Fig. 756.—*Turnip-picker.*

a Handle 4 feet long.
b Blade 10 inches long, including eye for handle.
c Breadth of blade 2 inches.

shown in fig. 757, which cuts the turnips into finger-pieces. In this form they are readily eaten by the sheep. The plan adopted, if the turnips are to be eaten on the land where grown, is to cast them into heaps alongside the net, a sufficient quantity for one or two days in each heap. The cut turnips are given to the sheep in the troughs or boxes, 7 to 10 boxes being sufficient for 100 sheep.

The heaps being laid down at intervals allows the troughs or boxes to be changed to fresh ground daily, so that the land is equally manured all over the field. One worker can in this manner feed 300 sheep.

The Cutter Cart.—The old-fashioned method of cutting turnips by means of the lever slicer has been largely superseded by the cylinder cutter, fig. 757, or the cutter cart, fig. 758. The cutter cart is an exceedingly useful invention. It consists of an ordinary farm box-cart with a root cutter of the barrel type placed underneath, driven from the wheels of the cart by tooth-gearing and

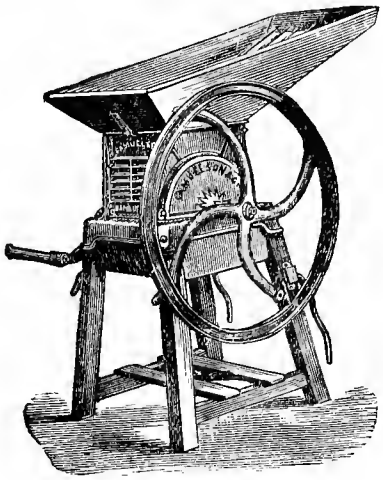


Fig. 757.—*Gardner's cylindrical turnip-cutter.*

clutch. By a lever the cutter is easily thrown out of gear. The cart is loaded with roots and set agoing, and the finger-pieces fall regularly as the cart proceeds. To adapt them for use where the cut roots are given to the sheep in boxes, some cutting carts are fitted with a large receptacle or framed box, also made to fix below the cutter barrel, which can be set to catch and carry all the turnips as they fall from the cutter barrel. The feeding boxes are set along

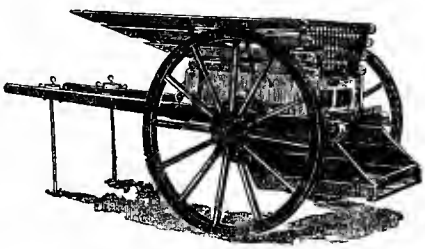


Fig. 758.—*Elder's turnip-cutting cart.*

the field in a row about 30 yards apart. The cart being loaded with turnips, it is pulled along the field, cutting as it goes. As it reaches each box the cut turnips are shovelled from the large receptacle underneath the cart into the feed boxes.

By this plan the feeding can be done all over the field instead of on one spot as with a stationary cutter.

Cake-breaker. — For sheep oilcake must be well broken. This is done by a strong machine such as that shown in fig. 759, made by Barford & Perkins, Peterborough. The oilcake is put into the hopper, the mouth of which is open upwards. The two rollers bruise it to any degree of smallness, by means of pinching-screws. The bruised cake falls down the spout into any vessel below.

Oats and Hay for Hoggs. — Some farmers keep hoggs on turnips all through the season. Others think it better to give them not more than two or three hours daily on the turnips, giving them during the remainder of the time the

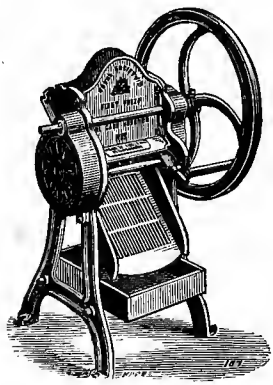


Fig. 759.—*Oilcake-breaker.*

run of a dry pasture-field, where they get ½ lb. of oats per head daily, and a handful of hay when the weather is hard. After the New Year the turnips must be cut for them.

Salt for Sheep.—Salt is frequently given to sheep on turnips, sometimes in the form of rock-salt, and in other cases as common salt. Sheep should have access to water when using salt.

Sheep on Turnips during Snow.—A fall of snow, driven by the wind, may cover the sheltered part of the field, and leave the turnips bare only in the most exposed places. In this case the sheep may have to be fed on the exposed parts, and if so the racks should be so placed there as to afford shelter. If the fall of snow should be very heavy the shepherd may have to get help to clear away enough of the snow to enable him to get the sheep fed.

Occasionally in stormy districts the sheep may have for a week or more to be fed without roots, say on cake and bruised corn and hay, but it is well to bear in mind that sudden changes in food are undesirable for all kinds of stock, and have therefore to be avoided as much as possible.

Unripe Turnips dangerous. — The danger of giving sheep access to unripe roots is referred to at p. 393. Information is given there as to measures for keeping ewes in good health on roots.

Blackface Sheep in Winter. — "It is always safe policy in stormy weather to supplement the natural food with hay. Blackfaces being naturally very hardy, they require less artificial feeding in winter than almost any other breed of mountain-sheep; yet in excessively severe winters the prudent manager does not leave his sheep to forage for themselves until it is too late to help them. So long as the snow does not get too deep, or is not frozen hard, they take little harm. Blackface sheep are excellent workers in the snow, and will toil bravely for a sustenance under the most trying circumstances. Hand-feeding is only resorted to when it cannot be longer avoided; and in that case the sheep are either removed to a lower district or fed on hay at home."[1]

Sheep in a Wood in a Snowstorm.—During severe snowstorms some farmers put sheep into woods, and supply them there with hay upon the snow round the roots of the trees. A precaution is requisite when the trees are Scots fir; their evergreen branches intercepting the snow are apt to be broken by its weight, and fall upon the sheep and kill them. Heavily loaded branches should therefore be cleared partly of their snow where the sheep are to lodge.

Rape for Sheep. — In the south of Scotland, and more generally in England, rape is grown for sheep. The consumption of rape by sheep is conducted by breaks in exactly the same manner as that of turnips; but rape is never stripped or pulled, the entire crop being consumed on the ground. In England, the rape

[1] *Blackface Sheep*, by J. and C. Scott, 109.

intended for sheep is sown broadcast and very thick. In Scotland, it is often raised in drills like turnips; and although not so convenient for sheep as when sown broadcast, yet the drills permit the land being well cleaned in summer, which renders the rape an ameliorating crop for the land. Rape is extensively used as a catch crop after early potatoes, and often gives an excellent return in fattening hoggs before Christmas.

Shelter for Sheep on Turnips.—Sheep on turnips have little shelter but what is afforded by the fences of the field or plantations. In some cases this is quite sufficient, but in others it is inadequate. Various devices are in use to provide shelter not merely against sudden outbreaks of stormy weather, but with the view of gradually improving the condition of sheep, both in carcase and wool.

An excellent temporary shelter for sheep on turnips may be made by the erection of a double line of hurdles or nets, the space between the lines being filled up with straw. A curve or angle can be introduced, and thus shelter can be provided for every quarter from which storms may come.

Experiments with Foods for Sheep on Roots.—A series of interesting and instructive experiments were carried out during the years 1903-1905 in East Lothian by the staff of the Edinburgh East of Scotland College for the purpose of ascertaining (1) the most profitable feeding-stuff to use along with cut swedish turnips, supplied *ad libitum*, and a daily allowance of from ¼ to ½ lb. of hay in the winter feeding of sheep; and (2) whether the use of feeding-stuffs effects any saving in the *daily* consumption of turnips when the sheep are allowed to take as many as they please. The prices of the foods were taken at—turnips 10s. per ton, hay £3, 10s., Bombay cotton-cake £5, 2s. 6d., dried grains £5, 12s. 6d., decorticated cotton-cake £7, 10s., linseed-cake £8, 5s., maize £5, 7s. 6d., crushed oats £6, 9s. 2d.

At these prices Bombay cotton-cake, linseed-cake, and a mixture of these two, were equally satisfactory feeding-stuffs. Dried grains also fed well, but the carcase-weight was not so good. It resolves the business into a question of the relative prices of the several stuffs. A rise of 10s. per ton will put any one above the profitable line.

THE TOTAL LIVE-WEIGHT INCREASE AND ITS COST.

Lot.	Description of characteristic food.	Total increase in 85 days.	Average increase per head per week.	Gross cost of food per cwt. of live-weight increase.	Net cost of food per cwt. of live-weight increase.
		lb.	lb.	£ s. d.	£ s. d.
I.	Bombay cotton-cake	754	2.07	2 1 3	1 11 7
II.	Bombay cotton-cake and linseed-cake	859	2.35	2 0 9	1 11 1
III.	Linseed-cake	926	2.54	2 1 4	1 11 7
IV.	Bombay cotton-cake and oats . .	727	1.99	2 3 4	1 14 1
V.	Dried distillery grains . . .	796	2.18	2 0 2	1 11 1
VI.	Decorticated cotton-cake and maize .	787	2.16	2 1 11	1 12 4

The average daily consumption of turnips in 1905 was 13.42 lb. per head—fully a pound more than was taken in 1904, and 3 lb. less than in 1903,—and none of the lots varied more than about ½ lb. from this quantity except Lot VI., which consumed only 11.93 lb. per head per day. Lot VI., however, stands highest for consumption of hay, taking 7.16 oz. per head per day, while the general average is 5.42 oz. The linseed-cake lot also is prominent as a consumer

of hay, thus corroborating former results; while the lot fed on Bombay cotton-cake runs to the other extreme, and has to be ranked along with those fed on dried grains and a mixture of Bombay cotton-cake and oats. That Bombay cotton-cake should have the same effect as a bulky ration of dried grains in reducing the consumption of hay seems remarkable. Nevertheless, it is upheld by all three experiments. The quantities of concentrated food taken by the respective lots is in close agreement, all being within ½ of an oz. of the general average of 13.31 oz. per head per day. No appreciable diminution of the amount of swedes consumed was observable between the lots which got concentrated feeding-stuffs and the lot which only got hay with its swedes in the earlier years. Of course, though no *daily* reduction of swedes was caused by cake-feeding, the cake-fed lots were sooner ready for the butcher than the sheep that did not get cake.

Cost of Turnip-feeding for Sheep.—The cost of turnip-feeding varies with the season and the crop as well as in different districts in the same season; but usually the price of turnips for hoggs ranges from 3d. to 5d. a-week, and for ewes and fattening sheep from 4d. to 8d. each sheep. These prices are sometimes exceeded when turnips are scarce in a backward spring. When it comes to extreme prices, however, the flockmaster in many cases can fall back on hay and corn or cake.

House-Feeding of Sheep.

Feeding Sheep in Sheds.—In former times the feeding of sheep in sheds was strongly commended by a few who had experimented upon it with satisfactory results. Others, however, were less successful, and while it was useful for small flocks, it has not come into extensive practice where large flocks are kept. Still, by several enterprising farmers who have carried it out with exceptional care, the practice is pursued with success.

A Ross-shire Example.

For many years the house-feeding of sheep has been carried on with marked success by Mr John Ross, Millcraig, Alness, Ross-shire. He states that by this method he can feed a larger number of sheep, at least a third more, than by outside feeding. Where sheep are fed largely in the house, and littered with peat moss-litter or straw, the fertility of a farm may be so increased that little artificial manure may be required. Sheep can be fattened in a shorter time in the house than outside, and home-grown food will go further. The sheep make steady and often very rapid progress. Mr Ross thinks the saving in death-rate alone would almost pay the interest on the cost of the shed. The sheep are protected from birds and maggots in summer, and from injurious extremes of weather in autumn, winter, and spring, and they fatten all the more rapidly because they undergo so little exercise.

The saving in food is undoubtedly substantial. With care, not a particle of any kind of food need be wasted. All green food and hay are passed through the chaff-cutter, and given in boxes, so that no food can be trampled under foot. The long feeding-trough is not suitable for sheep in houses, and in its place Mr Ross uses five-sided boxes, each side being large enough for two sheep—in all, ten sheep at each box. Much labour, of course, is involved in cutting, carting, and preparing food, as well as in littering and cleaning the shed, yet there is a certain saving, in that the shepherd has no wandering over fields, and no stakes and nets to erect.

The littering has to be carefully attended to. Whether straw or moss-litter is used, it should be raked over daily, and fresh small quantities spread almost every day. Sheep should never be allowed to stand in damp bedding, and if their feet are sound when put into the shed they rarely go wrong.

In the feeding of sheep in houses, distillery "draff," mixed with decorticated cotton-meal and cut hay, and allowed to ferment slightly, gives good results. Where "draff" is not available, a little treacle diluted with water may be used to make a mass of hay and meals palatable to the sheep.

Sheep-feeding Shed.—The shed used by Mr Ross (fig. 760) is 110 feet long

by 60 feet wide under one roof. It is divided across the middle into two equal areas by a concrete passage ten feet broad, and raised 3 feet above the floor-level of the shed. This passage affords facilities for storing foods and also for the mixing of them. These two main areas are again divided in the middle, thus providing four compartments of 30 feet by 50 feet, each sufficient to hold from 70 to 100 sheep. It is believed that compartments about this size, and square in shape or nearly so, are better suited than longer and larger enclosures, as in the latter the sheep are apt to run about too much when they are disturbed.

The sides and centre division of the shed are formed of concrete walls 3 feet high, with wooden framing 9 feet high above, to carry the roof. The lower half of the framing is lined with boards, while the upper half is composed of swing-doors, which may be opened or closed at will, thus providing admirable ventilation for the sheep without exposing them to draughts.

The roof of the shed is in one span, covered with corrugated iron, and supported by the centre division and side walls. The south end is half-sparred above the wall, and in the north end there are large doors. There are cart outlets for the convenient cleaning of

Fig. 760.—*Sheep-feeding shed—Exterior and interior.*

the shed. At one end of the centre passage there are stores for straw, hay, and roots, with accommodation for chaff-cutters and turnip-cutters, which are driven by a 1-horse-power petrol engine.

The manure is allowed to accumulate under the sheep until it can be conveniently removed. With the low concrete walls all round, the manure can rise to 3 feet in height without touching the wooden framework of the shed.

A shed such as this, to accommodate from 300 to 400 sheep, will cost about £300. At 10 per cent interest, this represents about 1s. 6d. to 2s. per sheep, but with three sets of sheep turned out each year the cost of the shed is only about 6d. for each sheep.

WINTERING SHEEP ON PASTORAL FARMS.

It is far more difficult to bring hill sheep well through the winter than it is to handle a lowland flock, especially in a winter of severe snowstorms. So long as the snow lies dry, even though it drifts badly, sheep manage, with careful guiding, to find a living; but they are sorely tried when a thaw and frost follow each other closely. The flockmaster who has not a plentiful supply of hay on hand is then in a bad plight.

"Home-Wintering" or "Sending Away."—On semi-pastoral farms, as on arable lands, this question does not arise; on purely pastoral holdings it is different.

On many of the higher and more exposed grazings the sheep have to be brought down to lower ground in winter, even if they are to be wintered on the farm; and, provided that an abundance of natural hay exists, it is better to winter the hoggs as well as the ewes at home. Wethers which are not ready for the butcher when they come off the hill in autumn, it may be necessary to send away for wintering on turnips, if they are to be fattened on grass the following summer; but if store sheep are likely to be cheap in the spring, it will pay best to sell the wethers direct from the hill in autumn to be winter-fattened on arable farms. Sending the hoggs away to be wintered costs 6s. or 7s. a-head, which is more than a second sheep-rent; and sheep that have to go back to hill pasture in the spring are altogether better wintered on hay at home if this should be practicable.

Wintering Sheep in Romney Marsh.—The same difficulty of wintering the hoggs at home has to be met by the Romney Marsh graziers; but whereas the hill-sheep farmers have to contend against winter storms and the failure of the frozen pastures, the Kentish sheep-breeders have to move their young sheep to higher grounds in winter owing to the flooding of their pastures, and not so much in search of better food as of sounder grazing. Many thousands of these Kent hoggs or tegs are sent out to winter in the adjoining counties at the end of September and brought back at the end of March every year, the wintering having cost 8s. or 9s. a-head, and sometimes more.

Saving Hay for Hill-farms.—Care has to be taken during summer to provide sufficient hay for the requirements of the flock in snowstorms. A general practice is to save or hain the enclosed parks which had been used early in spring for weak ewes and lambs. There are usually enclosures of this kind, extending in all to perhaps 6 to 10 acres for every "hirsel" of ewes, and sufficient hay should be obtained here for a flock of 500 ewes during an average winter. It is the duty of the shepherds to cut and secure this hay, and it is important that the work should be properly and seasonably attended to. For the supply of natural hay specially fertile "haughs" and other patches of green pastures throughout the farm are also saved.

Arable Land on Sheep-farms.—Where at all practicable there should be a certain area of arable land on sheep-farms, so that the supply of natural hay may be augmented by rotation hay, and that a moderate quantity of turnips may be grown. The advantages of this in stormy winters are very great.

Irrigation on Hill-farms.—Since *hay* is the principal food for mountain sheep in snow or black frost, it is of importance to procure this valuable provender in the best state, and of the best description. It has long been known that irrigation promotes, in an extraordinary degree, the growth of natural grasses; and perhaps there are few localities which possess greater facilities for irrigation, though on a limited scale, than the Highland glens of Scotland. Rivulets meander down those glens through haughs of richest alluvium, which bear the finest description of natural pasture plants. Were those rivulets subdivided into irrigating rills, the herbage of the haughs might be multiplied many fold, and hill-farmers are earnestly urged to convert them into irrigated meadows. Although each meadow may be of limited extent, the grass they afford is greatly increased in quantity and value when converted into hay.

One obstruction alone existing to the formation of meadows is, the fencing required to keep stock off while the grass is growing for hay. But the fencing should be made for the sake of the crop protected by it. Hurdles make an excellent fence. This difficulty is now greatly lessened by the introduction of cheap wire-fencing. Besides places for regular irrigation, there are rough patches of pasture, probably stimulated by latent water performing a sort of under-irrigation to the roots of the plants, which should be mown for hay; and to save further trouble, *this* hay should be ricked on the spot, fenced with hurdles, around which the sheep would assemble at times to feed through them in frosty weather

from the rick, and wander again over the pasture for the remainder of the day; and when snow came, the stells would be the places of refuge and support. As the hay in the stack is eaten, the hurdles are drawn closer to the stack, to allow the sheep again to reach the hay.

The practice now generally adopted, however, is to lay out the hay in handfuls on the snow, keeping plenty of room between the lines of hay.

On sheep-farms arable land might not itself be capable of yielding rent or profit, but it would most likely add greatly to the value of the adjoining pasture-land. Let it be always kept in view that the more food and shelter provided in winter for stock the less will be the loss incurred during the most inclement season.

Shelter on Sheep-farms. — There is still a marked deficiency of shelter on most pastoral farms in this country—that is, where it is not provided by the configuration and lie of the ground. More tree-planting for the providing of shelter for stock is urgently required, and much may also be done by the planting of suitable bushes such as broom, whin, and juniper. It used to be the custom with some sheep-farmers to fill their pockets on spring mornings with the seeds of the whin and broom, and in their walks over the sheep-farm, scatter these seeds on any likely spot. These eventually provide food for sheep in a stormy winter, besides growing into strong bushes capable of affording excellent shelter.

Stells for Sheep.

To admit of food being supplied with some degree of comfort to sheep during severe snowstorms on high grazings the existence of *stells* is desirable. There are still many store-farmers sceptical of the utility of stells, but on exposed farms their advantages are undeniable. A stell may be formed of a plantation or a high stone wall — either will afford shelter; but a plantation requires to be fenced by a stone wall.

Outside Stell.—Fig. 761 is a good *outside stell*, formed of plantation. The circumscribing stone wall is 6 feet high, the ground within it is planted with trees. Its 4 rounded projections shelter a corresponding number of recesses embraced between them; so let the wind blow from whatever quarter, two of the recesses will always afford shelter. The size of the stell is regulated by the number of sheep kept.

Sheep Cote or Sheds.—Much diversity of opinion exists regarding the utility of *sheep-cots* on a store-farm. These are rudely formed houses, in which sheep are put under cover in stormy weather, especially at lambing-time. Many object to sheep-cots on high farms, because, when inhabited in winter, even for one night, by as many sheep as would fill them, an unnatural height of temperature is thereby generated. Cots may be serviceable at night when a ewe or two

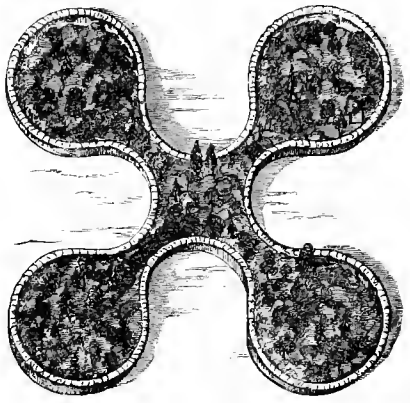


Fig. 761.—*Outside stell sheltered by plantation on every quarter.*

become sick at lambing, or when a lamb has to be mothered upon a ewe that has lost her own lamb; and such cases being few at a time, the cot never becomes overheated.

Paddocks for Sheep.—On an unsheltered breeding-farm it is desirable to have two paddocks, which are sufficient to contain invalid sheep, tups, and twin lambs, until strong enough to join the hirsel.

Forming Plantation Stells.—In making stells of plantations, it is desirable to plant the outside row of trees as far in as their branches shall not drop water upon sheep in their lair, such dropping never failing to chill them with cold, or entangle their wool with icicles. The spruce, by its pyramidal form, has no projecting branches at top, and affords

excellent shelter by its evergreen leaves and closeness of sprays, descending to the very ground. The Scots pine would fill up the space behind the spruce; but every soil does not suit the spruce, so in some cases it may be inexpedient to plant it. Larches being deciduous, their branches are bare in winter. Larches grow best amongst the *débris* of rocks and on the sides of ravines; Scots fir on thin dry soils, however near the rock; and the spruce in deep moist soils.

Size of Stells.—Stells should be as large as to contain 200 or perhaps as many as 300 sheep on an emergency; and even in the bustle necessarily occasioned by the dread of a coming storm, so large a number as 200 could be separated from the rest, and accommodated in a sheltered recess accessible from all quarters. Thus 5 such stells as fig. 761 would accommodate a whole hirsel of 1000 sheep.

Suppose, then, that 5 such stells were erected at convenient places—not near any natural shelter, such as a crag, ravine, or deep hollow, but on an open rising plain, over which drift sweeps unobstructed, and remains in less quantity than on any other place—with a stack of hay inside and a store of turnips outside, food would be provided for an emergency. On a sudden blast arriving, the whole hirsel might be safely lodged for the night in the two leeward recesses of one or two of these stells, and, should prognostics threaten a storm, next day all the stells could be inhabited in a short time.

Concave Stells.—Instead of the small circular stell, some recommend a form

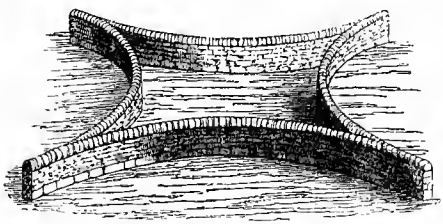


Fig. 762.—*Outside stell without plantation.*

without plantation, having 4 concave sides, and a wall running out from each projecting angle, as in fig. 762—each stell to enclose ½ an acre of ground, to be fenced with a stone wall 6 feet high, if done by the landlord; and if by the tenant, 3 feet of stone and 3 feet of turf—which last construction, if done by contract, would not cost more than 2s. per rood of 6 yards. In this form of stell, without a plantation, the wind would strike against a perpendicular face of the wall in either recess, and being directed upwards, would throw the snow down immediately beyond the wall into the inside of the stell. It is for this reason that objections are taken to inside stells.

Inside Stells.—Opinion is not agreed as to the best form of stell for high

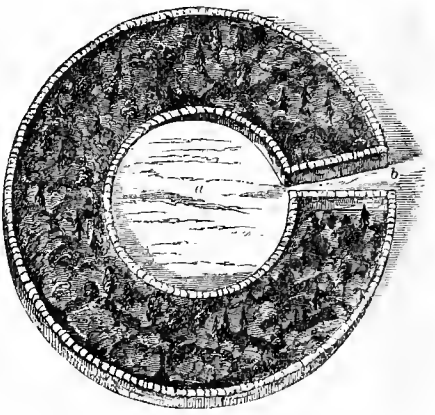


Fig. 763.—*Inside stell sheltered by plantation.*

pastures, where wood is seldom found. At such a height the spruce will not thrive; and the larch, being deciduous, affords but little shelter with its spear-pointed top. There is nothing left but the evergreen Scots fir for the purpose, and when surrounding a circular stell *a*, fig. 763, it would afford acceptable shelter to a large number of sheep. This stell consists of 2 parallel circles of wall, enclosing a plantation of Scots pine, having a circular space, *a*, in the centre for sheep, as large as to contain any number. For obvious reasons the entrance to the stell should be the same width all through, not wider at the outer end than the inner, as shown in the figure, which has the twofold disadvantage of increasing the velocity of the wind into the circle, and of squeezing the sheep the more the nearer they reach the inner end of the passage.

Circular Stells.—But where trees cannot be planted with a prospect of success, stells may be formed without them, and indeed usually are; and of all forms that have been tried, the *circular* has obtained the preference on hill-farms, as shown in fig. 764. Opinions differ as to size. Some think 8 to 10 yards inside measurement best; others prefer a larger size, perhaps 18 yards.

Giving Hay at Stells.—Circular stells should be fitted up with *hay-racks* round the inside, not in the expensive form of circular woodwork, but of a many-sided regular polygon. It is a bad plan to make sheep eat hay by rotation, as some recommend, because the timid and weak will be kept constantly back, and suffer much privation for days at a time. Let all have room and liberty to eat at one time, and as often as they choose. The hay-stack should be built in the centre of the stell, on a basement of stone, raised 6 inches above the ground to keep the hay dry. The circumference of the stell measures 160 feet round the hay-racks; and were 8 or 9 six-feet hurdles put round the stack, at once to protect the hay and serve as additional hay-racks, they would

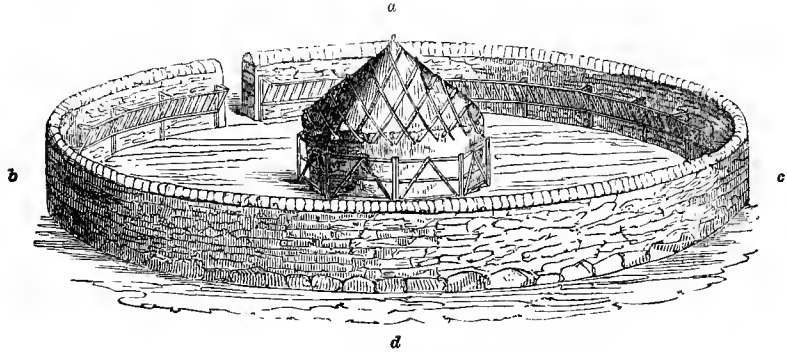


Fig. 764.—*Circular stell, with hay-racks and hay-stack.*

afford 47 feet more, which would give 1 foot of standing-room at the racks to each of 200 sheep at one time.

It is well to have some turnips stored beside the stells for use in a protracted snowstorm.

General Notes.

Bridging Rivulets for Sheep.—Where a rivulet passes through an important part of a farm, it will be advisable to throw *bridges* for sheep across it at convenient places. Bridges are best constructed of stone, and though rough, if put together on correct principles, will be strong; but if stone cannot be found fit for arches, they may do for buttresses, and trees laid close together across the stream, held firmly by transverse pieces, and then covered with tough turf, form a safe roadway.

Young Sheep best for Hill-farms.—The state of hill-pastures modifies the management on hill-farms. The hill-pasture does not rise quickly in spring, nor until early summer; and when it does begin to vegetate it grows rapidly, affording a full bite. It is found that this young and succulent herbage is not congenial to the ewe—it is apt in the autumn to superinduce in her the liver-rot; but it is well adapted for forwarding the condition and increasing the size and bone of young sheep. It is therefore safer for many hill-farmers to purchase lambs from south-country pastoral farmers, who breed Blackface sheep largely, as well as Cheviot, than to keep standing flocks of ewes of their own.

Nomenclature of Sheep.

The various classes of sheep are spoken of by different names throughout the country. A new-born sheep is a *lamb*, and retains the name until weaned from its mother. The generic name is altered according to the sex and state of the animal: when a female, it is a *ewe-lamb;*

when a male, a *tup-lamb;* and this last is changed to *hogg-lamb* or *wether-lamb* after it has undergone castration.

In Scotland, after a lamb has been weaned, until the first fleece is shorn, it is a *hogg*, a female being a *ewe-hogg*, a male a *tup-hogg*, and a castrated male a *wether-hogg*.

After the first fleece has been shorn, a ewe-hogg becomes a *gimmer* or *shearling-ewe*, a tup-hogg a *shearling-tup*, and the wether-hogg a *dinmont*. After the second shearing, a gimmer is a *ewe*, if *in lamb;* if not in lamb, a *barren gimmer* or *yeld ewe*, and if never put to the ram, a *yeld gimmer*. A shearling-tup is then a *2-shear tup*, and a dinmont a *wether*, but more correctly a *2-shear wether*.

A ewe three times shorn is a *twinter ewe* (two-winter ewe); a tup a *3-shear tup;* and a wether still a *wether*, or more correctly a *3-shear wether*.

A ewe four times shorn is a *three-winter ewe* or *aged ewe;* a tup, an *aged tup*, a name he retains ever after.

Tup and *ram* are synonymous terms, applied to entire males.

A ewe that has borne a lamb and fails to be with lamb again is a *yeld* or *barren ewe*. After a ewe has ceased to give milk she is a *yeld ewe*.

A ewe when removed from the breeding flock is a *draft ewe* or *broken-mouthed ewe;* gimmers unfit for breeding from are *draft gimmers;* and lambs, dinmonts, or wethers, when drafted, are *sheddings*, *tails*, *shots*, or *drafts*.

In many parts of England a somewhat different nomenclature prevails. Sheep bear the name of *lamb* until 8 months old, after which they are *ewe tegs* or *she hoggs* and *wether tegs* until once clipped. Gimmers are *theaves* or "two tooths" until they bear the first lamb, when they are *ewes of 4-teeth*, next year *ewes of 6-teeth*, and the year after *full-mouthed ewes*. Dinmonts are *shear hoggets* until shorn of the fleece, when they are *2-shear wethers*, and thereafter are *wethers*.

Rig and *chaser* are terms applied to a lamb when one of its testicles does not come into the scrotum.

Chilver is a name sometimes applied in Hampshire to ewe lambs from weaning time till Christmas, when they become tegs.

BRITISH WOOL.

The following notes on the origin, characteristics, and uses of British wool are contributed by Mr S. B. Hollings, Calverley, near Leeds:—

The United Kingdom is a place of variety, no matter from whatever standpoint judgment is given. And in those conditions which are responsible for the production of different types of sheep and wool—such as climatical and physical conditions—this variety is no less distinct than in other respects. Moreover, it is fairly safe to say that there are few countries more free from the disadvantages of unsatisfactory extremes of various kinds.

Sheep-farming is an industry which is by no means disregarded by those who seek their means of livelihood from the land. Still, in the United Kingdom it is not what it once was, on account of competition with colonial and foreign wool and mutton. Judged from the wool standpoint, this is perhaps truest in connection with the longer and most lustrous types, for it may be safely stated that many medium and short breeds — notably those of the white and crispy nature — cannot be seriously competed against, for the reason that they cannot be matched. But in regard to long wool, it should be encouragement to the British farmer to observe that he has the clear lead in the ideal conditions for wool production which are available for him. Pure lustre wool soon turns cross-bred-like in the warm colonies, this meaning loss to a greater or less extent of lustre, length, and uniformity, which are vital characteristics.

Again, in many localities cross-breds only are suitable, and in producing these experience has proved breeding diffi-

culties to exist which necessitate the employment of the shorter-wool types of sheep; and the types these produce, as previously suggested, do not advantageously compete with ours, for the reason that they differ from them so much as to make their use as substitutes impossible save in comparatively few cases. With respect to mutton, in spite of the enormous imports of chilled and frozen carcases, a strong demand still prevails for the home-grown article, and doubtless will be maintained to an extent which, along with the returns for high-class wool, will at least justify the continuance of this industry as much as any other in these days of small profits in all agricultural as well as in other callings.

That this idea is just now becoming prevalent is shown by the growing returns relating to sheep. With the development of the Colonial wool trade —most marked from about 1860—came a decrease in the numbers of sheep reared and quantity of wool grown in Great Britain; and this continued up to quite recent times, say 1905. Then, largely owing to the high prices prevailing, the turn in the right direction set in. During 1907 some 29 million sheep and lambs were depastured in the British Isles, and these yielded a return in wool of 130½ million lb. weight—a quantity of which England contributed, roughly, 57 per cent, Scotland 21½ per cent, Ireland 14½ per cent, and Wales 7 per cent.

Classification of Wools.

Coming to a study of the various breeds of sheep and the types of wool produced by these, the initial difficulty presenting itself is that of a suitable classification. As might be expected, sheep grown under such diverse conditions as obtain in this country, and subject to all the modifications cross-breeding can make, differ both in type of animal and in wool to an extent which makes a perfect classification almost impossible. The following system of classification has been adopted, not so much on account of its accuracy but because of its convenience for our present purpose:—

(1) Long-wool breeds — Lincoln, Leicester, Cotswold, Border Leicester, Wensleydale, Devon, and Romney Marsh.

(2) Short-wool breeds — Southdown, Shropshire Down, Suffolk Down, Hampshire Down, Oxford Down, Ryeland, and Dorset Horn.

(3) Mountain breeds — Blackface, Cheviot, Lonk, Herdwick, Dartmoor, and Exmoor.

The first class consists of types of very large and valuable sheep, chiefly inhabiting the heavier and richer agricultural lands of the western and midland counties of England. They yield wool of a long, strong, and lustrous type, most suitable for the lustrous and demi-lustrous kinds of dress fabrics and linings. Class 2, usually termed "Down-wool breeds," includes sheep of a smaller type, distributed over the more southern portions of England, and these produce wool of a white and crisp type, which is extremely useful for hosieries, flannels, serges, blankets, shawls, &c. From the types in both these classes growers in all wool-producing countries have drawn sheep for the building up and improvement of their flocks to an extent which has rightly earned for the United Kingdom the name of "The World's Stud Farm."

The mountain breeds in class 3, as might naturally be expected, are generally of a somewhat poorer order. Still, these breeds have their great value; without them much land would be sheepless, and as a consequence the range of wool qualities and the variety in price of fabrics—both so necessary for the varying requirements of the trade — would be disadvantageously less. The uses of these are in cheap serges, hosieries, blankets, flannels, and carpets.

A fourth class might very properly be made, consisting of "half-breds," or more correctly "cross-breds," produced by crossing the afore-mentioned types together for purposes of improving both mutton and wool, though chiefly the former. This class is somewhat large, with representatives scattered throughout almost all the sheep-growing areas, the wool yielded being of medium length and quality and suitable for medium-class dress fabrics, serges, hosieries, and woollens. As these are the cross-bred progeny of the breeds referred

to, and which will be detailed shortly, there is no necessity for a separate classification.

Long Wools.

Lincoln Wool.—Reverting to class 1—the Long-wool breeds—the Lincoln must be placed at the head. The Lincoln is the longest and strongest woolled of all British breeds—the wool being 10 inches and upwards in length; it is of excellent lustre for its type, of a fair degree of fineness (being 36's to 40's quality), soft to the handle, and very elastic. The fleece varies from 8 to 12 lb. in weight, though at times it is double this, and it will generally yield three-quarters of its greasy weight in scoured wool. It finds employment in the best dress fabrics, and, because of its exceptional length, strength, and elasticity, it forms the chief material in the "hog top" wrapping for the squeegee rollers of wool-scouring bowls, this material only being really serviceable under practical conditions.

Leicester Wool.—The Leicester is often placed along with the Lincoln breed, especially when the wool is considered. The Leicester wool is of an excellent type, and very lustrous in staple. Its uses are similar to those of the Lincoln wool, though it might also be noted that the addition of Leicester wool to Lincoln gives to that product the quality of softness to a remarkable degree.

Cotswold Wool.—The Cotswold wool is of the demi-lustre type, a shade finer than the Leicester (44's) and a little shorter, with a weight of fleece of about 8 lb., and is of much value in the making of dress goods and linings.

Border Leicester Wool.—The wool produced by this breed is excellent. It is of a demi-class, of good length and fineness (occasionally 46's quality), and is eagerly sought for dress fabrics, linings, &c.

Wensleydale Wool.—This breed, originally containing much Leicester blood, yields a fleece about 8 lb. in weight, of a somewhat curly but very lustrous character, of 40's quality and fair length, which is used for purposes similar to the lustre wools already noted.

Fleece of Devon Long-wools.—Of the two types of these sheep, one, designated South Ham, grows a somewhat fine and silky wool, generally used along with the wool of the ordinary Devon.

Romney Marsh Wool.—While not being of highest excellence in regard to wool, this is one of the most valuable of English breeds. The wool is demi-lustrous, of 46's quality, of good length, strength, and oftentimes with a fleece weight of about 7 lb.

Short-wool Breeds.

Typical of these is the Southdown, a breed which, because of its fineness, whiteness, and softness of wool, might even be called the English Merino. No breed has been more perfected, both as regards mutton and wool, than this. The wool is extremely crimpy, about 3 inches in length, of thick and massive staple, 50's to 56's in quality (this only being a point lower than strong Merino wool), with a fleece weight of 5 lb. In handle it is somewhat harsh and dry, this being due to chalk, which robs the fibre of its nature, and leaves it also somewhat impaired in strength as compared with the lustres. For hosieries, flannels, dress fabrics, serges, &c., it is in great demand.

Shropshire Wool.—For mutton and wool this breed gains the highest praise; in fact, with regard to the latter no breed is in greater demand. The wool is about 5 inches long, of 50's quality, open in fibre, and of excellent spinning quality.

Other Down Wool.—The wool of the Oxford, Hampshire, and Suffolk is fairly similar, being of the Down type just described. The uses are much the same.

Ryeland Wool.—The Ryeland breed yields exceeding fine and open wool of the Down type, but of a small fleece weight. This wool has suffered much in competition with strong colonial wool of the Merino type which forms a satisfactory substitute, and this has interfered with its development to a considerable extent.

Dorset Horn Wool.—This breed is of greater value for mutton purposes than for wool. The fleece is light—3 to 4 lb. in weight, with wool fairly long, fine and bright in appearance, of use as the ordinary Down types.

Mountain Breeds.

Blackface Wool.—The wool of this distinctive breed is not of good quality. It is long, thick 28's to 32's quality, harsh and kempy, of little lustre, and comparatively small weight of fleece, say 4 to 5 lb. It is used mostly in the production of carpets, rugs, &c., of medium class character. In some parts of the extreme north there is a variety of sheep whose fleece is described as wool and hair, the woolly part being shed, plucked, or shorn each year. This wool is of medium length and softness, of fair spinning quality, and is suitable for use as coarse serge and tweed-like fabrics.

Cheviot Wool.—The wool of the Cheviot breed is dense but fairly fine, 46's quality, and long, with a fleece of about 4 lb., being of greatest use in the making of tweeds, and for hosieries and flannels of medium types. Crossed on the Border Leicester, this gives the North or Leicester-Cheviot wool of Yorkshire for which much demand exists, large quantities frequently going to America.

Lonk Wool.—The wool of the Lonk sheep is less characteristic than that of the Cheviot breed, but it is easily disposed of for use in low tweed and serge making.

Herdwick Wool.—This breed yields a fleece of only 3 to 4 lb., the wool being coarse and open. It is of medium length, and fulfils requirements similar to the Blackface and Lonk wools.

Dartmoor and Exmoor Wools.—The wool yield of these breeds is small in weight, short in staple, but is soft. It is used for hosiery, blankets, and flannels.

Welsh Wools.—Generally two kinds exist which are natural to Wales. The first occupies the highest mountains, and yields wool often coloured black, greyish, white, and brown, but of a coarse nature and only medium in length. The second class, which also inhabits the mountains and hills, yields white wool from which the celebrated Welsh flannels are made. The wool is not uniform either in length or fineness, and it contains many kemps. The fleece weight is about 2 to 3 lb.

Irish Sheep and Wools.

As is the case with Welsh sheep, two distinct varieties exist in Ireland—those of the mountain and those of the vale. The mountain sheep somewhat resemble the Welsh and Scotch types, and yield similar wool, though these when carefully tended and grown in less elevated positions show marked improvement in character. Wool from the vale sheep (of which the Roscommon is the only pure breed) is of medium length (6 inches), and of the Down type, but longer of course, and is extremely serviceable in the making of hosieries and flannels, these often being of an excellent quality.

MARKETING OF LIVE STOCK AND DEAD MEAT.

Historical.

The origin of Markets and Fairs (says Mr Loudon M. Douglas, to whom the Editor is indebted for these notes) is wrapt in obscurity, but their history, so far as known, is of a most interesting character. The word market means traffic or trade, and although associated at one time with other pursuits, that meaning has been attached to it from the earliest historical times.

A fair has come to be looked upon as synonymous with a market, although at one period there was a marked difference, the market being liable to be held on any day of the week, whereas a fair was looked upon as a much larger function, and was only held on specified dates, which, in some cases, were proclaimed some time before.

There are many references to the customs of trade in Biblical times, showing that then the principles of marketing were well known. It was to Greece, however, that the principle of marketing owed one of its greatest advantages, as it was the Greeks who invented the idea

of a gold and silver coinage whose value should be unquestioned in any country of the world—that is to say, a universal coinage.

In early as in later times, fairs and markets were associated with religious festivals, and, indeed, as far back as Pythagoras (550 B.C.) it was said, on the authority of Cicero, that large numbers of people attended the religious festivals on those days merely with a view to trade. In later times this became a custom, and for many centuries fairs and markets were indissolubly associated with religious festivals, and the practice was carried to so great an extent that the principal fairs and markets during the middle ages were held on Sundays in the churchyards, there being thus a curious blend of business and devotion. The incongruity of the combination, however, was recognised in England in the reign of King Henry VI., during which period it was practically suppressed, on the ground that it was reminiscent of the buyers and sellers in the Temple.

Fairs were at one time common to all countries, but with the introduction of railways and quick transport, together with rapid postal and other means of communication, they have fallen in esteem, and now occupy only a secondary place in market transactions in all civilised countries.

Several of the great fairs of Europe are still carried on; and while some of them are specially devoted to the buying and selling of specific kinds of goods—such, for example, as the Leipzig Book Fair or the Nottingham Michaelmas Goose Fair—there are others which are devoted to the handling of general merchandise. We have also such fairs in the United Kingdom as the Glasgow Fair, Donnybrook Fair, and the Fair of St Bartholomew, the last-mentioned being the greatest fair that has ever existed. The original intention, however, in connection with these fairs—namely, that they should be for the marketing of goods—has been modified to suit the progress of civilisation, and they have dwindled down to mere occasions for a holiday.

It is of interest to recall that fairs and markets have always had some privileges, such as the right of exclusive dealing within a certain area of the fair while it lasted; the administration of justice in connection with the transactions, or anything that has happened during the fair, in a Summary Court, described as the Court of Piepowder (from the French, *pied poudré*, meaning dusty feet), and so described, it is supposed, because of the dusty feet of the suitors. In later days the Clerk of the Markets became the judge of this court, and exercised the jurisdiction previously held by representatives of the community. This privilege has, however, been altogether done away with, and the Clerk of the Markets is now merely a recorder of the transactions which take place within the modern market.

Modern Fairs.

Modern fairs, in so far as the United Kingdom is concerned, are associated almost entirely with agriculture, and the tendency is to dispense with them altogether. In Ireland, where they are very numerous, and where they are largely live-stock markets for the sale of cattle, sheep, and pigs, they serve a useful purpose in remoter districts, where they enable farmers to bring their produce to one centre, and where they may be sure of getting the price which rules in the fair for any particular class of animals. This advantage, however, is also being supplanted by the institution of live-stock scales at various railway stations, where live stock may be sold to agents of purchasers, by weight, in place of by guesswork as obtains in a fair.

"Market overt" was a term which was applied to transactions carried out in open market. In England such markets were held in specified places and on particular days, but in modern life this has been replaced by the institution of shops, which constitute "market overt" in the same way. In Scotland "market overt" does not exist, and the difference will be understood when it is stated that "the owner of goods sold (in 'market overt') by one who has stolen them, or to whom they have been lent, may reclaim them from the purchaser." In England the owner would have no such privilege.

These rights pertaining to fairs, with many others of a like character which need not be recalled, only serve to show

how much they are out of sympathy with modern institutions. They served a useful purpose in their day in enabling produce of various kinds to be conveniently distributed. But wherever railway communication is efficient—and that is fast becoming universal—the need for the fair entirely disappears. The time, therefore, appears to be not far distant when they will cease to exist altogether, and give place to methods more in keeping with modern ideas.

A market at the present day, in so far as agriculture is concerned, means a suitable place—which may either be covered or open—in which the produce of the farm may be bought and sold.

Every town and considerable centre of population has its market, and, in many places, corn markets are held on distinct days of the week from live-stock markets, so that the selling of the cereal produce of the farm need not interfere with the disposal of the live stock.

The Marketing of Dairy Produce.

In connection with dairy farming there are two systems of disposing of the milk. The first is by converting it into butter, and this applies to districts which are remote from populous towns, where milk is valued at considerably less than what it would fetch in the neighbourhood of a large population. It does not pay at any time to make butter in the neighbourhood of a large city, as the value of milk for household purposes is, on the average, at least one-third greater than what it is for butter-making purposes. The farmer, therefore, who is remote from the large town, and who practises dairying, either converts the milk which he sells into butter and feeds the calves and pigs on the separated milk, or he sells his whole milk to a creamery, which may be jointly supported by a large number of farmers; or it may be operated on co-operative lines, in which case it is usual for the farmer to take back again about an equal quantity of separated milk to the whole milk he has supplied. The average price of this separated milk is reckoned at a penny per gallon, and he is therefore able to feed his pigs and calves in the same way as he would if making butter on his farm, but with much less trouble than if he had a private butter-making establishment. In cheese-making, which is carried on very largely on such farms, there is not the same inducement towards co-operation, as it is entirely questionable whether co-operation in cheese-making is superior to what is accomplished by private enterprise. In either case, however, the residual whey is utilised as feeding, more especially for pigs.

Butter which is made on the farm is, in many cases, delivered to merchants or to consumers direct, but in many districts, more especially in Ireland, small farmers at the present day make what is termed "lump" butter, and which is simply butter produced in a crude way and without any regard to its proper grading. This lump butter is taken to butter fairs, which are held week by week, and is purchased by merchants, who mix all the lump butter together so as to make different grades of a uniform texture and appearance. These merchants term the produce, which they turn out in kiels, firkins, boxes, and packages — "factory" butter, so as to distinguish it from "creamery" butter, or such as is produced from the mixture of the milk. In the one case, the factory butter is the result of mechanical mixture of the various lumps; whereas, in the case of creamery butter, the production is the result of the mixture of the various supplies of milk. It is quite obvious that the creamery is very much more advantageous than the factory system, in so far as the production of a trustworthy and uniform article is concerned. The custom, however, among the small farmers of making their own butter is dying out but slowly, and is not likely to be extinguished until a greater number of creameries have been established, either by private enterprise or by co-operation.

Marketing of Live Stock.

The Markets and Fairs Weighing of Cattle Acts (1887 and 1891) require that all market authorities shall "provide and maintain sufficient and proper buildings or places for weighing cattle brought for sale within the market or fair, and shall keep therein or near thereto a weighing-machine and weights for the purpose of

weighing cattle, and shall appoint proper persons to have charge of such machines and weights and to afford the use of such machine and weights to the public for weighing cattle, as may from time to time be required."

By these provisions the business of buying and selling live stock has been placed upon a much better footing, especially for the farmer. The live-weight prices of the various animals are shown clearly, and it is therefore not difficult for the farmer to get fair value for his produce.

The fee which market authorities may charge for these facilities is twopence for each head of cattle and a penny for every five or smaller number of sheep or swine.

There are various live-weight scales made; their construction, however, is practically identical, there being only a slight variation in design. The weighing-machine (fig. 765) consists of an ordinary platform weighing apparatus, and to the platform a cage is attached, the weight of which is allowed for in the counter-balancing. Cattle are simply driven one by one into the cage and are weighed entire, and from such weights it is comparatively easy to compute what the nett weight will be. For this purpose several simple rules have been devised by Mr John D. M'Jannet. These rules are as follows:—

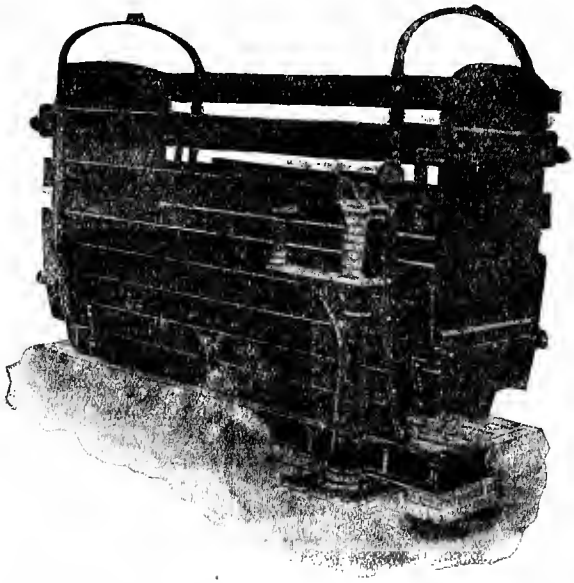


Fig. 765.

Live stock weighing-machine.

The use of the weighbridge for determining the live-weight of cattle has greatly increased. By its aid and the use of average tables for calculation, the approximate dead-weight of any animal can be determined. By this means both the seller and the buyer know, pretty nearly, the price per lb. which any price for the live animal will give. In this way a more satisfactory manner of marketing is arrived at than by buying or selling by "hand." The live-weight scale also facilitates sales by weight on the basis of either live- or dead-weight.

For ascertaining the approximate Carcase-weight of Fat Cattle from their Live-weight.

1. For wastefully fat Smithfield Club show cattle, multiply the live-weight by 7 and divide by 10.
2. For extra prime Smithfield Club show cattle, multiply the live-weight by 2 and divide by 3.
3. For prime butchers' bullocks found in ordinary markets, multiply the live-weight by 3 and divide by 5.
4. For fair killing beasts found in ordinary fat-stock markets, multiply the live-weight by 4 and divide by 7.
5. For old fat cows, just take one-half of live-weight.

Live- and Dead-weight of Fat Pigs.

Young fat pigs weighing alive at farm from 83 lb. up to 158 lb. will dress from 62½ to 70 per cent. Fat pigs of prime quality, weighing alive at farm from 160 lb. up to 410 lb., will dress from 67½ to 77½ per cent.

The following table shows approximately the available produce from fat sheep:—

Description.	Unfasted live-weight.	Per cent of mutton.		Average.
	lb. lb.	Lowest.	Highest.	
Three-part lambs . .	60 to 90	49	52	50 per cent.
Three-part hoggets .	90 to 120	50	54	51 ,,
Cross-bred hoggs . .	120 to 135	52	56	53 ,,
Half-bred ewes . .	140 to 180	50	53	51 ,,
Blackface ewes . .	116 to 136	50	52.7	51 ,,

A specially interesting and useful table is that which follows, and which gives the price per live cwt. of cattle between 80 and 83 stones, when the price "bid" and the weight are known. This table can be extended indefinitely on the same lines, and is a fair model of what such a table should be :—

TABLE SHOWING THE PRICE PER LIVE CWT. OF CATTLE WHERE THE WEIGHT AND THE PRICE BID IS KNOWN.

The Price Bid.			Live-weight of Animal.							
			80 stones or 10 cwt.		81 stones or 10 cwt. 14 lb.		82 stones or 10 cwt. 1 qr.		83 stones or 10 cwt. 1 qr. 14 lb.	
			Price per cwt.		Price per cwt.		Price per cwt.		Price per cwt.	
£	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
13	0	0	26	0	25	8	25	4	25	0
13	2	6	26	3	25	11	25	7	25	3
13	5	0	26	6	26	2	25	10	25	6
13	7	6	26	9	26	5	26	1	25	9
13	10	0	27	0	26	8	26	4	26	0
13	12	6	27	3	26	11	26	7	26	3
13	15	0	27	6	27	2	26	10	26	6
13	17	6	27	9	27	5	27	1	26	9
14	0	0	28	0	27	8	27	4	27	0
14	2	6	28	3	27	11	27	7	27	3
14	5	0	28	6	28	2	27	10	27	6
14	7	6	28	9	28	5	28	1	27	9
14	10	0	29	0	28	8	28	3	28	0
14	12	6	29	3	28	11	28	6	28	2
14	15	0	29	6	29	2	28	9	28	5
14	17	6	29	9	29	5	29	0	28	8
15	0	0	30	0	29	8	29	3	28	11
15	2	6	30	3	29	11	29	6	29	2
15	5	0	30	6	30	1	29	9	29	4
15	7	6	30	9	30	4	30	0	29	7
15	10	0	31	0	30	7	30	3	29	10
15	12	6	31	3	30	10	30	6	30	1
15	15	0	31	6	31	1	30	9	30	4
15	17	6	31	9	31	4	31	0	30	7
16	0	0	32	0	31	7	31	3	30	10
16	2	6	32	3	31	10	31	6	31	1
16	5	0	32	6	32	1	31	9	31	4
16	7	6	32	9	32	4	31	11	31	7
16	10	0	33	0	32	7	32	2	31	10
16	12	6	33	3	32	10	32	5	32	1
16	15	0	33	6	33	1	32	8	32	4
16	17	6	33	9	33	4	32	11	32	7
17	0	0	34	0	33	7	33	2	32	9
17	2	6	34	3	33	10	33	5	33	0
17	5	0	34	6	34	1	33	8	33	3
17	7	6	34	9	34	4	33	11	33	6
17	10	0	35	0	34	7	34	2	33	9
17	12	6	35	3	34	10	34	5	34	0
17	15	0	35	6	35	1	34	8	34	3
17	17	6	35	9	35	4	34	11	34	6

The Price Bid.			Live-weight of Animal.							
			80 stones or 10 cwt.		81 stones or 10 cwt. 14 lb.		82 stones or 10 cwt. 1 qr.		83 stones or 10 cwt. 1 qr. 14 lb.	
			Price per cwt.		Price per cwt.		Price per cwt.		Price per cwt.	
£	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
18	0	0	36	0	35	7	35	2	34	8
18	2	6	36	3	35	10	35	4	34	11
18	5	0	36	6	36	1	35	7	35	2
18	7	6	36	9	36	4	35	10	35	5
18	10	0	37	0	36	7	36	1	35	8
18	12	6	37	3	36	10	36	4	35	11
18	15	0	37	6	37	1	36	7	36	2
18	17	6	37	9	37	4	36	10	36	5
19	0	0	38	0	37	6	37	1	36	7
19	2	6	38	3	37	9	37	4	36	10
19	5	0	38	6	38	0	37	7	37	1
19	7	6	38	9	38	3	37	9	37	4
19	10	0	39	0	38	6	38	1	37	7
19	12	6	39	3	38	9	38	3	37	10
19	15	0	39	6	39	0	38	6	38	1
19	17	6	39	9	39	3	38	9	38	4
20	0	0	40	0	39	6	39	0	38	7
20	2	6	40	3	39	9	39	3	38	10
20	5	0	40	6	40	0	39	6	39	1
20	7	6	40	9	40	3	39	9	39	4
20	10	0	41	0	40	6	40	0	39	7
20	12	6	41	3	40	9	40	3	39	10
20	15	0	41	6	41	0	40	6	40	0
20	17	6	41	9	41	3	40	9	40	3
21	0	0	42	0	41	6	41	0	40	6
21	2	6	42	3	41	9	41	3	40	9
21	5	0	42	6	42	0	41	6	41	0
21	7	6	42	9	42	3	41	8	41	2
21	10	0	43	0	42	6	41	11	41	5
21	12	6	43	3	42	9	42	2	41	8
21	15	0	43	6	43	0	42	5	41	11
21	17	6	43	9	43	3	42	8	42	2
22	0	0	44	0	43	6	42	11	42	5
22	2	6	44	3	43	9	43	2	42	8
22	5	0	44	6	44	0	43	5	42	10
22	7	6	44	9	44	2	43	8	43	1
22	10	0	45	0	44	5	43	11	43	4
22	12	6	45	3	44	8	44	1	43	7
22	15	0	45	6	44	11	44	4	43	10
22	17	6	45	9	45	2	44	7	44	1

Carcase Competitions.

At the Smithfield Club Show, held in December 1908, the carcase classes were very much extended, and some interesting results were obtained. It was observed that the animals submitted in competition, first as live animals and latterly in the carcase, did not in every case gain the same awards in the two classes, the judgment of the live animal not being borne out when the carcases were examined. It is felt strongly by meat purveyors that more attention should be given to carcase competitions, which they regard as the only satisfactory test of an animal which is destined for food.

It may be of interest to record here the various entries in the classes of cattle, sheep, and pigs which obtained the highest awards at that show; and it may be observed that a comparison of the actual weights realised with the weights stated in the foregoing table, indicates that the rules laid down are fairly accurate.

TABLES OF THREE CARCASE CLASSES ENTERED AT SMITHFIELD CLUB SHOW, LONDON, 1908.

STEERS NOT EXCEEDING TWO YEARS OLD.

Catalogue Number and Name of Exhibitor.	Breed.	Live-weight.	Carcase Weight in 8-lb. stones and lb.	Per-centage of Meat.	Placed by Judges Alive.	Carcase Awards.	Realised per 8 lb.
		cwt. qr. lb.	st. lb.				s. d.
584 Coed Côch Trustees	Welsh	11 3 12	101 6	61.30	...	...	4 0
585 J. J. Cridlan	Aberd.-Angus	12 1 13	115 4	66.71	4th	H.C.	4 4
586 Sir Walter Gilbey, Bt.	Cross-bred	11 1 12	101 7	64.00	3rd	...	4 6
587 G. Young	Cross-bred	10 1 2	92 2	64.17	H.C.	2nd	6 0
588 J. & G. Young	Cross-bred	10 3 1	94 0	62.41	H.C.	H.C.	5 0
589 W. A. Sandeman	Cross-bred	11 2 20	108 5	66.43	1st	C.	4 8
590 James McWilliam	Aberd.-Angus	11 1 26	108 4	67.50	...	4th	4 8
591 Joseph Godman	Cross-bred	11 2 7	107 4	66.41	...	...	4 4
592 R. M. Greaves	Welsh	10 1 0	90 3	63.00	...	...	4 8
593 Finlay Munro	Cross-bred	10 1 16	97 4	67.00	...	3rd	5 8
594 R. G. Nash	Cross-bred	10 1 18	94 1	64.58	2nd	1st & Ch.	7 0
595 Lionel Phillips	Cross-bred	11 1 8	103 6	65.46	...	...	4 4
596 J. Douglas Fletcher	Aberd.-Angus	11 2 18	108 4	66.46	...	R. & H.C.	4 4
597 Univ. Coll., N. Wales	Welsh	11 3 10	104 5	63.12	H.C.	...	4 6
598 Sir J. Colman, Bart.	Cross-bred	12 0 18	110 1	64.68	C.	H.C.	4 0
599 Duchess of Newcastle	Cross-bred	9 0 26	84 0	65.00	...	H.C.	5 0
600 Viscount Tredegar	Shorthorn	13 0 9	124 6	68.10	...	...	3 6
	Averages 1908	11 1 3	102 6	65.11	...	...	4 8⅞
	" 1907	11 1 8	103 2	65.14	...	...	4 5

ONE PURE LONG-WOOLLED WETHER SHEEP ABOVE 12 AND NOT EXCEEDING 24 MONTHS.

		lb.	lb.				
633 J. G. Young	Cheviot	165	100	60.60	2nd	...	4 0
634 Henry Simpson	Wensleydale	171	111	64.97	...	...	3 8
635 Sir J. Gilmour, Bart.	Blackfaced	147	99	67.35	4th	...	3 8
636 J. D. Fletcher	Cheviot	133	88	66.16	C.	2nd	5 6
637 William Kennedy	Cheviot	125	76	60.80	...	...	4 6
638 Univ. Coll., N. Wales	Welsh M'n	102	63	61.76	3rd	4th	6 0
639 Robert Graham	Cheviot	116	72	62.06	...	R. & C.	5 0
640 Sir R. W. Jardine, Bt.	Cheviot	119	76	63.86	...	3rd	5 6
641 W. Vivers & Son	Cheviot	116	75	64.65	1st	1st	7 2
642 Henry Dudding	Lincoln	304	205	67.43	...	...	2 6
	Averages 1908	149¾	96½	63.96	...	...	4 9
	" 1907	130	86	65.98	...	...	5 4

ONE PIG, NOT EXCEEDING TWELVE MONTHS OLD, ABOVE 220 LB. AND NOT EXCEEDING 300 LB. LIVE-WEIGHT.

Catalogue Number and Name of Exhibitor.	Breed.	Live-weight.	Carcase Weight.	Per-centage of Meat.	Placed by Judges Alive.	Carcase Awards.	Realised per 8 lb.
		lb.	lb.				s. d.
716 H. Peacock	Berkshire	304	187	61.51	2nd	2nd	3 10
717 Briant Brothers	Large White	282	201	71.27	H.C.	3rd	3 6
718 Lionel Phillips	Tamworth	285	256	89.78	3rd	...	3 2
719 J. Douglas Fletcher	M. White	281	233	82.91	4th	4th	3 4
720 Vis. Com. M. C. A.	Berkshire	288	210	72.91	1st	1st & Ch.	4 8
721 Kenneth M. Clark	Large Black	254	163	64.17	...	...	3 8
722 Thomas Goodchild	Large Black	239	183	76.56	...	R. & H.C.	3 6
723 D. E. Higham	Berkshire	283	243	85.86	...	...	3 2
724 John Neaverson	Large White	274	228	83.21	...	...	3 4
725 Harold Sessions	Large Black	293	237	80.88	...	...	3 4
	Averages 1908	278	217	76.90	...	...	3 6½
	" 1907	276	229	82.87	...	...	3 3
	" 1906	256	213	83.10	...	...	3 9¼
	" 1905	258	213	82.66	...	...	3 10

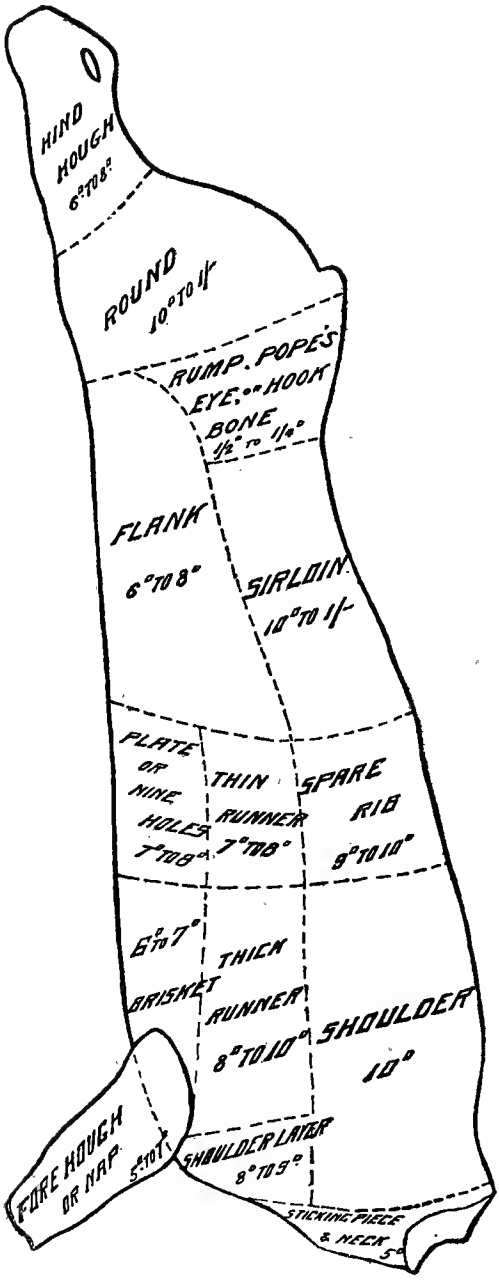
The Meat-Supply.

Since the nineteenth century entered on its last quarter an entirely new set of conditions has sprung up in connection with the meat-supply of the United Kingdom. Frozen and chilled meats of all descriptions have been imported from various foreign countries, notably the United States, Canada, Argentina, Australia, New Zealand, Holland, and Scandinavia; and, so far as can be seen, the supplies from these various sources are likely to go on increasing. That these supplies are already substantial is clearly seen from a glance at the supplies of dead meats which pass through the Central Markets of London.

According to the returns issued in 1908, four tons out of every five which pass through the London Central Meat Markets, in order to supply the 6,000,000 consumers in London, are of foreign origin. That is to say that the meat-produce derived from the United Kingdom, and which passes through Smithfield Market, amounts to only 20½ per cent of the total. The actual figures for five years are given in the following table:—

TABLE SHOWING THE QUANTITIES OF HOME AND FOREIGN MEAT PASSING THROUGH SMITHFIELD MARKET, LONDON.

Year.	Weight of Market Supplies.	Increase on previous year.		Origin or Sources of Supplies in terms *per cent.*			
		Weight.	Rate per cent.	"English killed" and United Kingdom productions.	Imported productions, chilled or frozen.		
					North and South American.	Australasian.	Continental.
	tons.						
1869	127,981	...	...	97.7	nil.	nil.	2.3
1877	197,631	69,650	54.4	89.0	7.4	nil.	3.6
1887	259,383	61,752	31.2	77.5	9.5	5.8	7.2
1897	391,707	132,324	51.0	47.9	18.8	20.3	13.0
1907	417,057	25,350	6.4	36.6	24.6	25.7	13.1



[Copyright of Loudon M. Douglas.

Fig. 766.—*Side of beef.*

The various cuts of beef which are shown on the diagram are those which obtain throughout the United Kingdom, there being, however, slight modifications in various districts. It will be observed that the "Round," "Rump," and "Sirloin" are the highest-priced parts.

The importation of frozen dead meat to this country began about 1876. The earlier consignments came chiefly from the United States of America, but in 1879 two Scotsmen, named Bell and Coleman, began to bring cargoes of frozen meat from Australia. Since then the supplies have steadily increased, until during 1907 they reached the gigantic total of 18¾ million cwt. of all kinds of meats, valued at about £42,000,000 sterling. Hitherto much of the meat so imported has been frozen to about 18° F., but it has been found that the frozen product commands a much smaller price than "chilled" meat, which is carried at a much higher temperature—namely, at 28° F. Consequently, arrangements have now been made to bring in, from Argentina and the United States, most of the meat in the "chilled" condition. It has been found that chilled meat can be sold so as to compete with the home-grown article, and frequently fetches higher prices. As this means an enormous increase in the revenue derivable from imported meat, it is not to be wondered at that the great shipping companies are strenuously endeavouring to bring all their meats under such conditions.

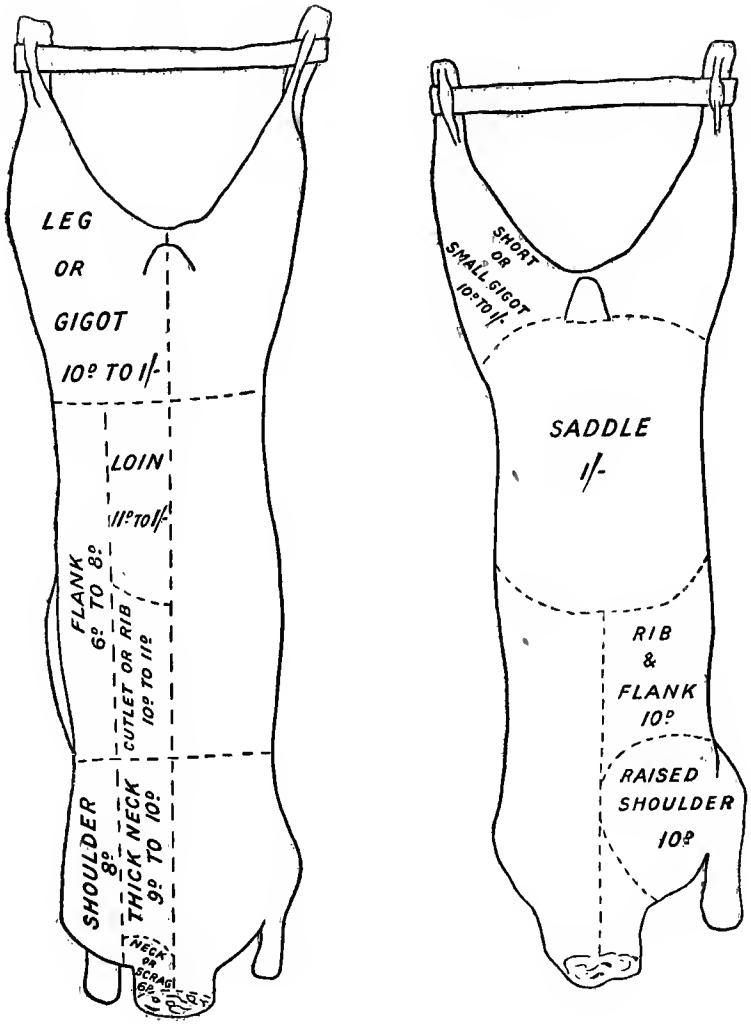
Marketing of Meats.

So far there has been very little attempt to develop the handling of meats at the farm. A good many farmers slaughter their own pigs in order to make "farm-cured" bacon, but they generally rely upon selling their cattle and sheep on the hoof. In order, therefore, that they may the better understand what the meat-purveyors require, it may be of interest to refer in some little detail to the processes in use in the handling of meats.

When live stock intended for human food passes through mar-

kets, it is destined, as a rule, for either a private slaughter-house or a public abattoir.

A private slaughter-house has many objections, the greatest being that it is difficult to control the meat which may be handled there. The conditions also which necessarily exist in a private



[Copyright of Loudon M. Douglas.

Fig. 767.—*Cutting up of a carcase of mutton.*

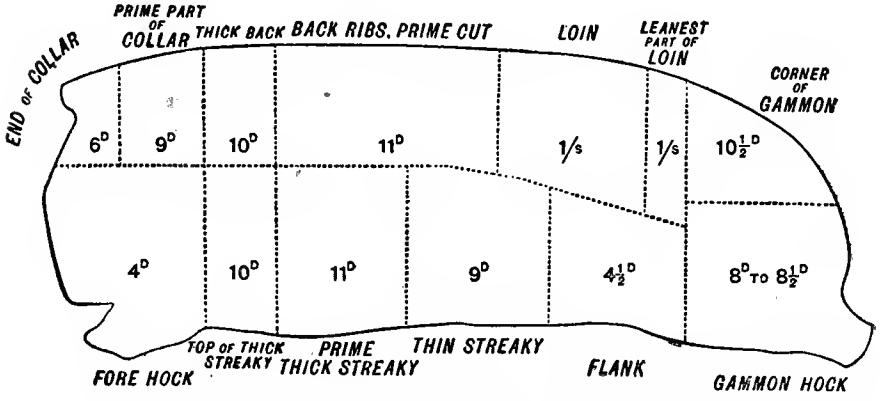
The methods in use for dividing up the carcases of mutton vary slightly in different parts of the United Kingdom, but the general custom is shown on the two illustrations, where the names of each portion and the average prices are given. It will be observed that the dearest portions are the legs and saddle, and it is to the increase of these that breeding should be directed. The V space between the legs should be as small as possible, and the greatest development should take place right across the "saddle."

establishment as compared with a public one must be inferior, owing to the fact that the cost of installing proper equipment would be too great for a private individual. There are, of course, many exceptions to this, but only in excep-

tional cases should private slaughter-houses be allowed to exist.

Public slaughter-houses are very frequently erected in conjunction with cattle-markets, so that when live stock is disposed of the animals may be conveniently conveyed to the abattoir adjoining. This relation of the market to the abattoir is also convenient in another way, as it enables complete inspection on the hoof to take place, so that any animal which is suspected of being diseased can be intercepted before it enters the abattoir.

The principal advantages in the handling of animals in an abattoir are, that expert slaughtermen are employed, and complete control and veterinary inspection is possible. Meat can also be matured in a properly constructed abattoir much better than in small premises, as usually plenty of ventilation is provided, and chilling rooms form part of the equipment also. That part of technical detail, however, is not one which very greatly interests the farmer,—what he is concerned with is the product itself. It is his business to supply meat which will conform to the requirements of the meat-purveyor, and what these requirements are can be best understood from a diagram showing



[Copyright of Loudon M. Douglas.

Fig. 768.—*Side of bacon.*

In the cutting up of a side of bacon cured in the "Wiltshire" method, as shown in the illustration, it will be observed that the loin brings the highest price. Breeding should therefore be directed towards increasing the development of the live animals so that the fleshy part of the back from which the loin is derived should form the leading feature.

what parts of the animal bring the highest prices. In the diagram in fig. 766 the British method of cutting up a carcase of beef is illustrated.

The cutting up of the carcases of sheep (fig. 767) is not so detailed an operation, and it does not involve quite so much skill, as the cutting up of beef. The breeding of sheep, however, for the meat-purveyor should be strictly on the lines of producing the largest quantity of meat to the smallest proportion of bone, and it is particularly desired that the meat of the hind-quarters should be extremely full. The transverse sections through the middle should show a large richly coloured "eye." When these two points are accentuated in any sheep, it answers then to the meat-purveyor's requirements.

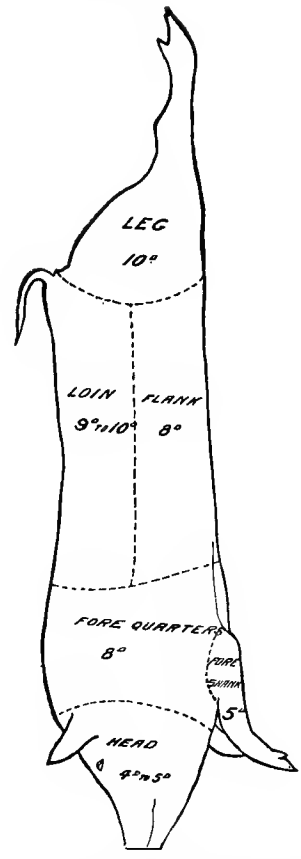
In so far as pigs are concerned, they may be required for fresh pork or bacon, but in either case the points are pretty much the same, so that in breeding for bacon purposes farmers will answer the requirements of the meat trade all round, and the points to be studied cannot better be illustrated than by reference to the diagram showing the section into which a side of bacon is usually cut, and the prices of each (figs. 768 and 769).

Farmers as Retailers.

At various times attempts have been made to organise societies of farmers in

order to retail the products of the farm—not so much on the lines of co-operation as of private enterprise. Such concerns have been instituted in various towns with considerable success, notably in dairying and also in the purveying of meat. Whether this is an advantageous line for farmers to follow or not it is hardly possible to say at the present time, for as yet the experience of it has been limited. If, however, a company of farmers would combine together to open several meat-purveyors' establishments, and in that way save all the cost of marketing and intermediate profits, there seems no reason why such a scheme should not succeed. It is altogether a question of capable management and a proper understanding of how to utilise the by-products of the business.

Much profit is lost in the Meat Trade of the United Kingdom owing to the fact that a very large number of meat-purveyors slaughter their own animals, and are thus unable to utilise offals to the fullest extent. It would be far better for each one of these to hand over all the offals from his animals to a central depot, where they would be treated in bulk at very much less cost and more efficiently than could possibly be done on the small scale. The residual products are also entirely lost in small slaughter-houses, instead of being converted into fertilisers, which should be the final destiny of the waste material in connection with the handling of all animals used for food.



[Copyright of Loudon M. Douglas.

Fig. 769.—*Carcase of pork.*

The sections into which a side of pork is divided are not numerous, the principal being the leg and the loin, which, both in market pork and in connection with bacon-curing, bring the highest prices.

INSECT ENEMIES OF LIVE STOCK.

Dr R. Stewart Macdougall contributes the following notes on the Insect, Mite, and Tick enemies of stock.

Of the four chief classes of jointed-footed animals (Arthropoda) only two, the Insecta and the Arachnoidea (ticks and mites and spiders), contain enemies of stock. These insect and mite and tick enemies affect stock in different ways: *e.g.*, they may be complete parasites, passing their whole life on the affected animal—*e.g.*, lice and mange mites; or they may be parasitic for part of their life—*e.g.*, the bots of cattle and horses and the sheep maggots; or they may visit the animal for a meal of blood and then leave—*e.g.*, cleg and stable-fly.

INSECTS.

A description of the characteristics of insects and of the various orders of insects will be found in vol. ii. p. 442, &c. Of the various groups of insects only three contain stock enemies — viz., the Diptera or two-winged insects, the Mallophaga or biting lice, and the Parasitica section of Hemiptera—viz., the Sucking Lice.

THE TWO-WINGED FLIES.

The insects of this order have a complete metamorphosis (the keds are marked exceptions). The mouth-parts of the adult are fitted for a liquid diet, the mouth-parts of some being modified to form lancets by which wounds can be made previous to the sucking up of blood. The larva of a Dipterous insect is a legless maggot. The families of Diptera containing stock enemies are—

Tabanidæ or true gad-flies.
Œstridæ or bot-flies.
Muscidæ—*e.g.*, stable and sheep maggot-flies.
Hippoboscidæ—*e.g.*, ked and forest-fly.
Pulicidæ (a degraded family), or fleas.

True Gad-Flies.

These insects are harmful only in the adult condition when by their mouth lancets they wound for blood. The wound is made, never by a sting at the end of the body but always by the modified mouth-parts. The eggs are laid elsewhere than on stock, and the maggots of this family are not parasitic on stock.

The Ox Gad-fly (*Tabanus bovinus*) measures up to an inch in length and has a stout body; the thorax is brown-black and hairy and has dark stripes; the abdomen is red-brown, and along the middle line of the back is a row of whitish triangles. The flies are found from about the end of May onwards. Both maggot and pupa live in the soil. Another large Tabanus is *Tabanus sudeticus*, a somewhat darker fly than *bovinus*. Smaller species are *T. autumnalis*, *T. bromius*, *T. maculicornis*, and *T. cordiger*.

T. bovinus and *T. sudeticus* approach stock with a marked humming note; the smaller Tabanidæ land quietly on the beast visited for a meal.

The Cleg (*Hæmatopoda pluvialis*) measures half an inch in length and has a narrow body; there are pale stripes down the thorax, and a pale grey band and greyish spots on the upper surface of the abdomen. The grey wings have light-coloured markings. The maggot and pupa live in the soil. The flies are about in late summer. There are two other British species, *H. crassicornis* and *H. italica*.

The Blinding Breeze Flies (*Chrysops*) may be distinguished from the Cleg by the presence of three small eyes on the top of the head (in addition to the two large compound eyes). The compound eyes are golden-green with purple lines and spots. The flies have a somewhat square-shaped abdomen, and when at rest the wings are held somewhat apart. There are four species—*C. cæcutiens*, *C. relicta*, *C. quadrata*, and *C. sepulcralis*. The two first are the commonest.

The family Chironomidæ or Midges contains many British species. Most are harmless, but several species of the genus Ceratopogon cause great annoyance to man by their "bites." Every one knows the viciousness of these midges in summer and autumn. The larvæ of the midges live, some of them in the soil, others in water. For keeping off the "biting" midges, Theobald gives the following as successful: a mixture of ½ oz. pure carbolic acid, 1½ oz. spirits of lavender, 1 drachm of eucalyptus-oil.

Œstridæ or Bot-Flies.

The adults are hairy flies with abortive or rudimentary mouth-parts. The adult flies cannot wound stock,—it is the larva or maggot which is harmful in this family,—yet stock seem instinctively to fear the flies, and stampede as these approach to lay their eggs. There are three sections of Œstridæ—viz.:

Gastricolæ, in which the larvæ live in the alimentary canal — *e.g.*, horse-bot;
Cuticolæ, in which the larvæ live below the skin—*e.g.*, ox-marble flies;
Cavicolæ, in which the larvæ crawl up the nostrils to the frontal sinuses—*e.g.*, sheep nasal-fly.

Horse Bot-Flies.

Gastrophilus equi.—This yellow-brown fly (fig. 770) measures from one-half to two-thirds of an inch long. There are red hairs on the thorax and yellow-brown hairs on the abdomen. The female fly can be told from the presence of a well-marked ovipositor directed downwards and forwards.

The eggs—pointed at the attached end and blunt at the free end—are glued to the hairs of the horse; they measure $^1/_{12}$ inch. The eggs are fixed to the hairs on fore-leg and shoulder, and sometimes to the mane. When the egg is ripe the maggot protrudes itself, and is conveyed by means of the horse's tongue to the horse's mouth, ultimately reaching and fixing itself to the stomach. The first part of the stomach is chiefly infested; but, in case of bad infestation, the stomach generally may be more or less covered. The maggots hold on by means of their mouth-hooks, not leaving till they are full fed. The full-grown larva is rounded, and measures ¾ inch; in addition to its mouth-

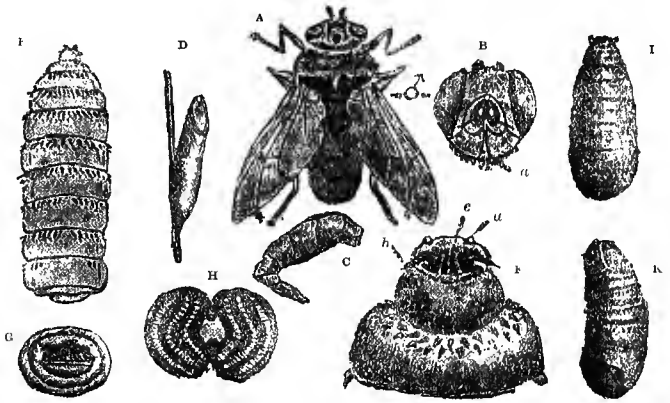


Fig. 770.—*Gastrophilus equi.*

A, Male, twice natural size.
B, Head of same, with *a*, the channel on the face.
C, Abdomen of female, showing ovipositor.
D, Egg on a hair, magnified.
E, Grown larva, magnified.
F, Front end of larva. *a*, antennæ; *b* and *c*, mouth-hooks, much magnified.
G, Last segment of larva seen from behind.
H, Stigmatic plates at hind end of larva, greatly magnified.
I, Pupa.
K, Pupa seen from the side.

(A to D after Brauer; E to K after Nitzsche.)

hooks it has a double row of prickles on each segment. When full grown the larva leaves go, and, passing along the alimentary canal of the host, drops to the ground, where pupation takes place. The flies are commonest in July and August.

Gastrophilus hæmorrhoidalis is a smaller and darker species. The eggs of this fly are darker, and are sometimes laid on the long hairs about the lips. The maggots may fix themselves in the thorax and back of the throat or in the rectum.

The presence of the *Gastrophilus* maggots may set up inflammation and ulcers, and may cause interference with the free passage of food or passage of waste matter: loss of appetite and condition are symptoms of attack.

Horses out at grass should be examined and any eggs removed by thorough grooming. The *hæmorrhoidalis* maggots can be removed by hand from the anal region, and those in the laryngeal region by pushing into the throat a stick covered with an oil-saturated cloth. Where emaciation seems due to the presence of the maggots the following has been recommended as a draught once a fortnight: 2 oz. turpentine and 20 oz. raw linseed-oil mixed.

THE OX-WARBLE FLIES.

There are two species of these—*Hypoderma lineata* and *Hypoderma bovis*. The larvæ of these flies are the cause of immense loss in Britain every year.

Hypoderma lineata.—The Striped Ox-Warble Fly is so named from the longitudinal bands on the front part of the thorax, light stripes alternating with dark. It measures half an inch in length, and is black, with a hairy covering of whitish, red-brown, and black hairs. The flies are found from May till September.

The females lay their eggs in rows, attaching them, as a favourite place, to the hairs just above the hoofs. The cattle, in licking themselves, convey the maggots to their mouth, and the young maggots—spiny at this stage—fix themselves to the gullet. The larva moults, and in doing so loses its spines, and proceeds to wander from the gullet through the tissues of the host, ultimately reaching the back. Here another moult takes place, which leaves the maggot spiny. Lying below the skin, the maggots give rise to great irritation. A swelling, with a hole leading to the outside, marks the position of the larva. The larva lies in the warble with its tail end pointing to the opening; at this tail end the spiracles for respiration are situated. When full grown the maggot presses itself out of the warble and falls to the ground for pupation. Pupation takes place under cover of the last moulted skin, and this puparium or pupa-case hardens and becomes black in colour. In due course the fly, when ready, issues through a cap-like opening at one end of the puparium.

Hypoderma bovis measures over half an inch in length; it is dark coloured, banded with yellow hairs; there are yellow hairs on the face and yellow and black hairs on the thorax; the hairs on the abdomen are yellow-white in front, black in the middle, and yellow-red behind.

There are conflicting views as to the life-history of *H. bovis*. Miss Ormerod's view was that the eggs were laid on the hairs of the back, and that the maggots, on hatching, bored directly through the hide. Others hold that the life-history resembles that of *H. lineata*—viz., that the eggs or maggots are licked into the mouth, and that after a wandering they reach the tissues of the back. Recently Carpenter, as the result of careful experiment with calves kept under observation, has stated that the eggs are laid chiefly on the legs, not on the back, both fore and hind limbs being struck near the hock. Carpenter also inclines to the view that the larvæ, on hatching, bore through the skin, and after a more or less prolonged wandering reach the back. While maggots may reach the back by way of the mouth, Carpenter's careful experiments seem to prove that this is not necessary. He kept six calves muzzled in such fashion that they neither could lick themselves or their neighbours, and yet five out of the six calves showed warbles.

Once having reached the back, the rest of the life-history is the same as for *H. lineata*.

H. bovis is commonest from midsummer till the end of July, but not limited to this period. According to the trade reports, February till September is the time for warbled hides, but chiefly April and May.

The Ox-Warble Flies cause loss in various ways. The presence of the flies bent on egg-laying alarms the cattle, which gallop about. The irritation caused by the spring maggots under the skin prevents the cattle grazing at peace, and they fail to put on flesh. After the cattle have been slaughtered there is loss in dressing the carcases from what is called "licked beef" or "butchers' jelly," this inflamed tissue having to be cut and scraped away. Then there is the loss from hides showing the warble holes.

Treatment.—As a fly deterrent various dressings are recommended, the dressing to be applied along the spine at regular intervals. It must be admitted that there is considerable testimony in favour of the value of this treatment. Yet careful experiment indicates that the hairs of the back are not a favourite place for egg-laying, and if so the dressing of the back cannot be a measure for recommendation. As against the maggots, once they are present in the back, it is a sometimes practised measure to treat the warbles separately in order

to kill the maggot. The maggot lies in the warble with the tail end—where the spiracles are—uppermost, and advantage is taken of this to apply to each some sticky or greasy or poisonous substance which will suffocate and kill the pest. This mode of treatment, however, is not to be recommended.

The best treatment is to squeeze out the maggots and kill them. This is not a difficult measure when the maggots are approaching the end of their growth, and ought to be the most practised treatment. Regular and methodical attention to this on the part of our stock-owners, if continued over a few seasons, would go far to annihilate this enemy.

Another species of warble-fly — viz., *Hypoderma diana* — is the cause of warbles in deer.

The Sheep Nostril-Fly (Œstrus ovis).

This fly (fig. 771) measures about half an inch in length; the upper surface of the head is light-brown; the upper surface of

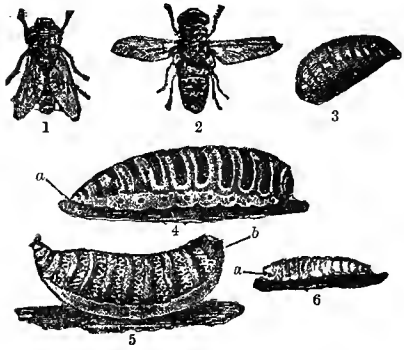


Fig. 771.—*Œstrus ovis.*

1 and 2, Adult fly.
3. Pupa.
4 and 5, Full-grown larva.
6, Young larva.
a, Head-end.
b, Tail-end.

(After Riley.)

the thorax is light-brown or yellow to grey, and has dark tubercles; the ringed abdomen is brown-yellow, with dark spots; the legs are brown. The wings are glassy, and extend, when the insect is at rest, beyond the body. The newly-hatched maggots are white and worm-like; they have two mouth-hooks and transverse rows of little spines on the under surface of the abdomen; there are also spines at the hind end. When full grown the maggot measures between ¾ inch and 1 inch.

Life-History. — In warm sunshiny weather the females fly towards the sheep, laying their eggs, just ready to hatch, or newly-hatched maggots, at the sheep's nostril. The maggots, by their mouth-hooks and spines and anal processes, draw and push themselves up the nostril. The maggots feed on the secretions resulting from the irritation caused by their presence and their prickings; they become mature in the frontal and maxillary sinuses of the sheep. When full grown the maggots are sneezed out on to the pasture, where, a little below the surface, or in a sheltering tuft, they become pupæ, the fly maturing under cover of the last moulted skin of the maggot, which becomes dark in colour. The number of maggots in a head varies, a small number being the commoner thing.

Symptoms attending infestation are: discharge from the nostrils of the infected sheep; sneezing and snorting in the endeavour to get rid of the larvæ; tossing of the head; rubbing noses on the ground; a staggering gait; and difficulty in breathing.

Treatment.—Dressings on the nostrils of the sheep to prevent the flies laying their eggs or maggots. A contrivance for this purpose is to have V-shaped salting-troughs in the field, the sides of these being smeared with tar, which reaches the nose of the sheep as they lick the salt.

Infested sheep should be isolated before the maggots are sneezed on to the pasture. In bad cases the sheep should be sent for slaughter. Remedial measures are not of much avail, and fumigation, or an operation to remove the maggots, would be practised only with valuable animals.

FAMILY MUSCIDÆ.

This important family includes the Tsetse-Flies, one of which (*Glossina morsitans*) carries the parasite of tsetse-fly disease, so fatal to the domesticated animals in some parts of Africa; while another species (*Glossina palpalis*) carries the parasite that causes Sleeping Sickness.

There are three British blood-sucking species; the others do not draw blood, but are harmful in other ways. The blood-sucking species are *Stomoxys calcitrans*, *Hæmatobia stimulans*, and *Lyperosia irritans*.

The Stable-Fly (Stomoxys calcitrans).

This fly resembles the common house-fly, but is shorter and stouter; the wings when Stomoxys is at rest are held wider apart, and the head is more erect and carries the cruel proboscis. In stables where these flies settle on the horses' legs the pricks of the proboscis cause the beasts to stamp, and in sensitive fine-skinned animals a swelling may follow the wound. Cows sometimes suffer severely.

The life-history of this fly has recently been worked out by Newstead.[1] Farmyards and stables are, according to Newstead, favourite haunts of the fly, which also is found in fields, parks, and open woods. The fly is also common in towns. At night the flies may be found resting on beams and rafters in open sheds in farmyards. Fresh dung was offered to flies kept in captivity, and eggs were laid on it. With larvæ fed on moist sheep's dung (the eggs were obtained from captive females), at an average day temperature of 72 per cent, and night temperature of 65° F., the whole life-cycle was completed in 25 to 37 days. With drier material and light admitted the cycle took 42 to 78 days. After prolonged observation, Newstead succeeded in finding the females laying their eggs in the open, in a heap of grass mowings, in September.

HÆMATOBIA STIMULANS.

This fly, smaller than a house-fly, has the head much smaller than that of *S. calcitrans*, but the palpi are much longer. The flies live in the open and suck blood, the pain of their "bite" being severe.

LYPEROSIA IRRITANS (*Hæmatobia serrata*).

This is the smallest of the blood-sucking Muscids, and measures 4¼ to 5 millimetres in length. It is a pest of cattle. This fly has been introduced to the United States and Canada, where it has been the cause of considerable loss, interfering with the feeding of the cattle and with their digestion, as well as causing a loss of blood. From the habit which these flies have of resting, when in numbers, on the horns of the animals, the name Horn-Fly has been given in America.

The Common House-Fly (Musca domestica).

Although several species of fly are found in our houses, *Musca domestica* is the commonest from midsummer onwards to the autumn. The fly measures 6.5 to 9 millimetres; it is dark ash-grey in colour; there are four longitudinal black streaks down the back of the thorax; the abdomen is checkered with black, and a dark streak runs down the middle of its upper surface. The egg is white and oval; the larva is a white or grey-white maggot, with a pointed head end and a blunt posterior end. In the course of its development it moults twice, and three stages can thus be distinguished. Full grown it measures ⅜ inch. The puparium is oval and brown.

Life-History.—The female lays on an average 120 eggs. The favourite place for egg-laying is horse manure, but the eggs may be laid on the manure of other animals, where this is fresh and not too dry, and in decaying comestibles. The number of eggs laid by a single female may reach 400 to 500. In warm countries the whole life-cycle can be passed through in a fortnight. Gordon Hewitt,[2] in his experiments at Manchester, found the life-cycle to vary from 20 to 30 days: taking the shortest times for the different stages in the various experiments, then, 15 days is the result.

It is clear, then, that enormous numbers of house-flies can be reared in a season, and there is no doubt that this means considerable risk to the community. There is the fouling of food and drink with the dung-stained feet of

[1] *Journal of Economic Biology*, 1907, vol. i.

[2] *Memoirs and Proceedings of the Manchester Literary and Philosophical Society*, 1906-07.

the flies, and a soiling with their excrement. As feeders on garbage there is evidence that harmful bacteria can be conveyed to foods and milk; the bacteria of typhoid and tuberculosis can be carried, and probably the prevalence of summer-diarrhœa in children, so baneful in its results, is due to carriage of bacteria by the fly.

Excrement in the open should be covered. Middens are great places for the breeding of *Musca domestica*—the maggots sometimes swarming in such. Howard recommends the application to such of chloride of lime, a shovelful to be thrown over every day or two's addition to the heap. A wise measure would be to protect exposed eatables with gauze.

The Blue-Bottles or Meat-Flies.

Two species of Calliphora — viz., *C. erythrocephala* and *C. vomitoria*,—well known by their loud buzzing noise and their blue colour, lay their eggs on meat and fish or on decaying organic matter, to which they are attracted by their sense of smell.

C. erythrocephala has a red face and a black beard; *C. vomitoria* has a black face and a red beard. The eggs are laid in little heaps, and hatch in twenty-four hours. The voracious maggots are well known, as also are the brown oval pupa-cases. The length of the life-cycle varies with the food and the temperature. In experiments made by me in August in the open air the whole life-cycle was passed through in a month.

Calliphora erythrocephala also "strikes" sheep: the maggots pass their life on the sheep, not boring deeply into the flesh, however, as the green-bottle (Lucilia) maggots do, and fall to the ground for pupation when they are full grown.

The Green-Bottles.

These belong to the genus Lucilia, and there are two closely resembling species —viz., *Lucilia sericata* and *Lucilia cæsar*. *Lucilia cæsar* is green with a whitish face, and the upper border of the buccal cavity is reddish. *L. sericata* is, if anything, smaller; both face and buccal cavity are white. The colour is bright green, but associated with this is a bluish bloom absent in *cæsar*.

Lucilia sericata.

This fly is, *par excellence*, the sheep maggot-fly. It can be observed flying about the sheep during hot weather. The fly measures about 1/3 inch long and about 7/8 inch in spread of wing. The eggs are yellowish-white, and measure about 1/16 inch. The larva is a legless maggot, but is capable of an active crawling movement; the head end is provided with two mouth-hooks; the hind end is blunt, with tubercles round the margin, and two plates with the spiracles. The pupa cases are brown, and rounded or barrel-shaped.

Life-History.—The female fly may lay as many as 500 eggs, these being fixed to the wool in clusters of 20 or more. The maggots from the eggs feed at first externally, but later bore into the flesh. When full grown they drop to the ground for pupation.

Attack is worse on lambs than on old sheep. The flies are found at work from May onwards. Moist, warm, muggy weather, or warm sunshine after showers, favours the fly.

Symptoms of attack are: Matting together of the wool fibres, a continual wagging of the tail, rubbing and biting of the sheep in their efforts to allay the irritation caused by the maggots, much inflammation, oozing from the sores of an evil-smelling sticky fluid, discoloration of the wool which falls out and in bad cases does not grow again, rapid loss of condition.

Treatment.—Keep the hind-quarters of the sheep clean: a good measure is to clip the wool of the tail and between the hind-legs. Carcases of dead animals should be burned or buried so that they may not serve as breeding-places. Dipping with sulphur as an ingredient. The neighbourhood of wounds should be dressed with an ointment of butter and flowers of sulphur or with spirits of tar. Infested sheep should be isolated. The maggots are not difficult to kill; they should be picked or rubbed off, or where they have got to work the wool may be shorn a little, the affected parts being dressed with fly-oil, or with a mixture of turpentine and rape-oil in equal parts, or with dilute paraffin-oil, finishing off with a dusting of sulphur. Very much depends on the care of the shepherd, and there should be repeated inspection.

The Flesh-Flies, or Family Sarcophaginæ.

Our best known species is *Sarcophaga carnaria*, a greyish-looking hairy fly. The female measures half an inch in length and the male less. The upper surface of the thorax is whitish-grey with longitudinal black stripes. The dark-coloured abdomen has a number of whitish-grey markings resembling a check. The female fly deposits live maggots on decomposing animal or vegetable matter, and perhaps in wounds. The maggots are white-coloured, and have their upper surface granulated. Pupation takes place in some convenient shelter-place; the pupa case is black-brown. *Sarcophaga carnaria* maggots are chiefly scavengers, but on the Continent there is a dangerous species, *S. magnifica*, whose maggots are found on live animals.

FAMILY HIPPOBOSCIDÆ.

This is a family of flies with flattened horny body, and parasitic on various animals, chiefly birds. Some have well-marked wings; in others the wings are rudimentary or may be absent. An interesting feature in their biology is their mode of reproduction, the eggs hatching and the larvæ developing in the body of the mother right up to the period when the larvæ are ready for pupation.

The Ked or Kade or Sheep Louse-Fly (Melophagus ovinus).

This insect (fig. 772) is wingless, and measures about a quarter of an inch in size. The colour is brownish; the body is bristly. There is a tubular proboscis. The square thorax bears three pairs of bristly legs, each ending in two strong two-toothed claws and a plumed bristle. The keds live among the wool of the sheep, coming towards the surface on a sunny day, hiding nearer the skin among the fibres of the wool in colder weather. They are not able to live long away from their hosts, from which they derive shelter, warmth, and food. After shearing, the keds are not found so spread over the body, but collect more on the neck, shoulders, and ears. The larva is nourished within the body of the mother on a secretion prepared in uterine glands; small shining red-brown puparia are fixed to the wool, and the adult, when ready, issues by a crack at one end.

Keds—especially in lambs, which remain thin in consequence—give rise to much irritation by their puncturings. Infested sheep bite, scratch, and rub themselves. Where the skin has been punctured by the proboscis dark spots show, surrounded by a red area.

Treatment.—Dipping, the bath containing some substance which will poison or suffocate the pests. After dipping, a few days should elapse before the sheep

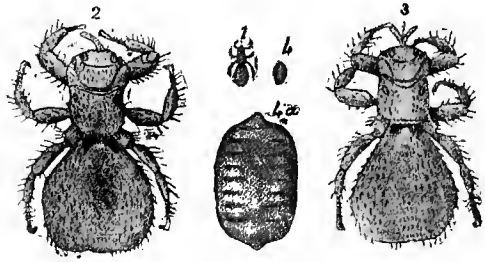


Fig. 772.—*Melophagus ovinus.*

1, Female, natural size.
2, Male, magnified; view of upper surface.
3, Male, magnified; view of lower surface.
4, Pupa case, natural size.
4*a*, Pupa case, magnified.

are allowed to return to their old feeding-grounds, so that any keds that may have previously tumbled to the ground may have perished. A second dip should follow the first, say, after a fortnight.

The Forest-Fly (Hippobosca equina).

The New Forest is the chief locality for this fly, but it has been recorded from other parts of the south of England and from Wales. The fly is winged and retains its wings; it is a quarter of an inch long. The head is yellow, and there is a dark stripe in the middle of the face; the thorax is brown, and has three yellow patches, two in front and one in the middle. The toothed claws give the fly a very secure grip of the horse. The puparia laid by the female are white at first, but soon darken. The flies are found fixed to parts of the horse's body where the skin is soft and the hair not plentiful. The flies, as they crawl

over the horse or donkey, cause great annoyance and irritation, and strange animals especially plunge and rear or roll themselves about.

The Deer Forest-Fly (Lipoptera cervi).

This insect measures $^1/_5$ inch; it is yellow-brown in colour and is tough and bristly; the legs are short and hairy. Both males and females can be found all through the winter on the deer, the insects being by this time wingless. To begin with, however, both sexes have wings, but when a host has been reached the wings are shed or torn off and only stumps remain.

The females lay small shining puparia among the hairs of the deer. The flies emerge in summer, and from autumn onwards both males and females may be found running over or clinging to the deer.

Ornithomyia avicularia.

This species is a bird parasite; it is found, for example, on fowls and pigeons, and is generally distributed throughout Britain. The fly measures less than a quarter of an inch; it is greenish-yellow in colour, with the upper surface of the thorax darker; the wings are smoky. The fly retains its wings, and can at pleasure leave one host and fly to another.

PULICIDÆ OR FLEAS.

This family is made up of insects whose wings are reduced to mere scales. Three species of the genus Pulex may be distinguished thus:—

Pulex irritans, the flea of man, without comb-like spines on head and prothorax.

Pulex avium, the flea of fowl and pigeon; 24 to 26 comb-like spines on the prothorax.

Pulex serraticeps, the dog-flea; 7 to 9 comb-like spines on the lower edge of each side of the head and on the sides of the posterior edge of the prothorax.

Fleas are laterally compressed insects with bristles on thorax and abdomen; the six legs are also bristly—the hind pair the longest—and end in claws. The males are smaller than the females and have the end of the abdomen tipped up. Eggs are laid in dusty corners, cracks in the floor, on mats, and among the hairs of the dog. Legless larvæ hatch out, which can wriggle actively, assisted by the hairs on the segments and by hooks at the hind end. When the maggot is full grown pupation takes place under cover of a silky cocoon that may be covered with dust particles.

The dog-flea also passes to man and the cat. *Pulex avium* attacks the pigeon and fowl and other birds; it can prick man. Sitting hens are annoyed, and where the fleas are plentiful growth of the young birds is interfered with.

Treatment. — Careful and regular sweeping and cleansing of dog-kennel and hen-house with lime-wash. Infested dogs, having first been bathed with soapy water, should be sprinkled with fresh pyrethrum powder. Creolinated water —a 10 per cent solution—is a good wash for flea-infested animals. A little sawdust soaked in naphthaline and placed in the nests of sitting birds will give them peace.

THE BLOOD-SUCKING LICE OR PEDICULIDÆ.

These insects belong to the Parasitica section of the Order Hemiptera. They have a sucking proboscis capable of expansion and contraction. When not in use this proboscis is invisible, having been withdrawn into its sheath; the sheath carries a number of hooklets which bury themselves in the skin and so hold the sucking-tube steady. The legs have a two-jointed tarsus, and the tarsus ends in a stout claw which bends up and forms, with a projection from the lower extremity of the tibia, an apparatus by which the parasites cling and creep.

The females lay eggs or nits, which are glued to the hairs of the host. Development is rapid; the young forms that issue from the eggs feed and grow and moult themselves to the adult form without any resting pupal stage.

Three genera may be noticed:—

The genus Phthirius has the thorax as broad as the abdomen, the two passing into one another without constriction—*e.g.*, *Phthirius inguinalis*, the crab-louse, against which the best remedy is staves-acre ointment. The genus Pediculus has

the thorax narrower than the abdomen; the abdomen, broadest at the middle, narrows at the anterior end, so that the thorax and abdomen do not seem sharply marked off from one another; the eyes are prominent. To this genus belong the head-louse (*Pediculus capitis*) and body-louse (*Pediculus vestimenti*).

The genus Hæmatopinus has the thorax narrower than the abdomen; the abdomen and thorax, owing to the difference in breadth, are sharply marked off from one another. Hæmatopinus species infest the dog, horse, ox, pig, goat, and rodents.

THE BITING LICE OR MALLOPHAGA.

The name Mallophaga means wool-eaters, and indicates that these lice live not on blood, but on epidermal scales, feathers, hairs, scurf, &c.

When present in numbers on the host they are the cause of itching, unrest, and irritation.

The Mallophaga are flattened forms, with their mouth-parts fitted for biting and cutting. The head is large and broad; the first segment of the thorax is distinct, but the other two segments are not marked off from the abdomen; the legs are short and have one or two claws; in one section the legs are fitted more for clinging, in the other more for locomotion. Wings are absent.

There is an incomplete metamorphosis, there being no resting pupal stage in the life-history. Pear-shaped eggs are laid on the hair or feathers, and the young, which hatch, differ externally from the adult only in size; they become sexually mature after some moultings. Mammals may be the hosts, but birds more commonly, hence the Mallophaga are often called the Bird-lice.

The two sections are the Philopteridæ, characterised by their comparative sluggishness, their feet being more adapted for clinging; and the Liotheidæ, which are more active.

PHILOPTERIDÆ.

Trichodectes. — This genus infests dog, horse, ox, sheep, goat. The species have wide flat heads, beset on the upper surface with hairs. The first segment of the thorax is well marked; the second and third segments are fused to form one piece; the abdomen is nine-jointed, and has scattered hairs, these being most marked at the edges; the abdomen of the female is cleft at the end.

Lipeurus.—This genus has an elongated narrow body. Species infest fowls, ducks, geese, turkeys, pigeons, pheasants. *Lipeurus variabilis* of the domestic fowl may be taken as an example. This insect may be found in numbers amongst the primary and secondary feathers, and can move about actively. The head is round; the hind part of the thorax is longer and broader than the fore part; the under surface of the thorax shows a brownish spot; the abdomen is spotted and banded, and has projecting hairs at the edges. The prevailing colour is pale-yellow, with the spots fawn coloured and the bands dark. The male measures 1.9 mm. and the female 2.2 mm.

Goniodes.—The species of the genus Goniodes have flatter, wider bodies than the last.

Goniodes dissimilis is the chicken Goniodes. The head is wider than long; the abdomen is broad and oval, and has on the middle of each segment two bristles; there are curved spots at the edges. The general colour is whitish, with darker spots and fawn-coloured bands. The male measures 2 mm. and the female 2½ mm.

The genus Goniocotes is also made up of flattened wide forms. *Goniocotes hologaster*, the chicken-louse, is much smaller than the last, the male measuring about .9 mm. and the female 1.3 mm. The head is as wide as long and broadest just behind the antennæ. Colour yellowish; there are brown-black bands.

LIOTHEIDÆ.

Of this section, fitted for running, *Menopon pallidum* may be taken as an example. This is the commonest and most troublesome of all lice infesting the fowl. It runs with great nimbleness among the feathers. The head is angular and crescent-shaped; the temples bear four bristles; the thorax is the same length as the head in the male, but longer than the head in the female. The abdo-

men is oval and elongated, and each segment carries a series of bristles. The abdomen of the male is longer and narrower, and has four long bristles at the end. The colour is pale-yellow, with bright fawn spots on the abdomen.

Treatment for Lice, both Sucking and Biting.

There should be scrupulous cleanliness with periodical disinfection of stable, kennel, and hen-house. Dust-baths should be provided for birds. Of ointments which, rubbed into the hair, will suffocate the pests, may be mentioned: (1) one part sulphur to four of lard; (2) stavesacre ointment made of oil of stavesacre one part, lard seven parts; or (3) a decoction of one of stavesacre seeds to four of lard.

For rubbing in or for washing there is a large choice of preparations: (1) a decoction of one ounce of stavesacre seeds to a quart of liquid, half water half vinegar; (2) an infusion of two parts stavesacre to one hundred of vinegar; (3) one part petroleum to ten of rape-oil; (4) a 5 per cent mixture of boiled tobacco or tobacco juice from manufactured tobacco, diluted in the proportion of 1 to 100; (5) creolinated water—*i.e.*, a 5 per cent solution of creolin. When animals are combed the comb should be dipped in a strong solution of soda, or comb and brush should be dipped in paraffin emulsion, or in one quart of water to which has been added 2 oz. of carbonate of soda and ½ oz. of powdered stavesacre.

A repetition of the treatment should follow in some days, so that any of the pests which have hatched from eggs that escaped the first treatment may be killed before they become mature and proceed to egg-laying.

ACARINA OR MITES.

Acarina is an Order of the class Arachnoidea; it denotes the mites as distinct from the spiders and the scorpions.

Mites are small animals with head and thorax soldered together to form a cephalothorax which is united throughout its width to the abdomen: the two parts are so joined that no sign of the union may be visible. The mouth apparatus is fitted for biting or piercing or sucking, the various united pieces forming the rostrum. This rostrum is made up of a pair of mandibles and a pair of pedipalps, the latter consisting of a basal part and a several-jointed palp capable of free movement.

The adult mito has four pairs of legs, which vary in shape according to the habit of life of the mite; the legs end in hooks or hairs or suckers. When the mite hatches from the egg only six legs are present; the fourth pair appears later. Respiration may be by tubules opening on the outside of the body, but in many parasitic forms the breathing is directly through the skin. The sexes are separate, and reproduction is typically oviparous; exceptionally live young may be produced. Five mite families are of importance here.

Family Demodecidæ.

This is a family of very small worm-like mites with the cephalothorax and the transversely striated abdomen distinguishable from one another. The mandibles are little stylets. The adults have four pairs of very short legs; those legs are three-jointed. Eyes are absent, and respiration is through the skin.

Out of the egg there comes a larva, legless in some varieties, in others having three pairs of rudimentary legs; after two moults there is a well-developed mouth and eight legs. These Demodex mites live in the sebaceous glands and the hair follicles of mammals.

Demodex folliculorum (fig. 773) is common in the sebaceous glands of man's face; a favourite place is the skin of the nose, but the presence of this mite in man is of no importance. There are varieties on the dog, cat, horse, ox, sheep, pig, goat, and mouse. The Demodex mites are very small, the largest—that of man—measuring only $^1/_{80}$ of an inch or a little over.

The worst Demodex attack is that on the dog, where it causes follicular mange, an affection of the skin characterised by pustules and falling out of the hair. All the stages from larva to adult may swarm in the sebaceous glands and the hair follicles, particularly the latter; the mites are fixed by their rostrum. It is young

dogs chiefly that are attacked, and short-haired dogs more than long-haired ones. The disease generally begins about the head, particularly in the neighbourhood of the eyes, and extends gradually to the fore-legs, feet, and sides.

The symptoms vary according to the stage of the disease. To begin with, there is only a slight itching and small papules and a redness marking the places where there has been a slight loss of hair; as the disease spreads the skin wrinkles, larger pimples appear, filled with a purulent material, and when these burst red crusts mark the place; the itching may also increase. If some of the purulent matter be squeezed out and examined under the microscope the parasites are revealed. A characteristic odour, suggestive of mice, comes away from the patient.

Follicular mange does not yield readily to treatment; and where it has persisted and spread, death almost certainly follows. A good dressing is Peruvian balsam dissolved in alcohol—one part balsam to four of alcohol—the solution to be rubbed daily into the skin after the contents of the pustules have been squeezed out. Another ointment in use is made of five parts creolin and a hundred parts lanoline.

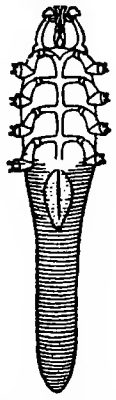


Fig. 773.—*Demodex folliculorum.*
Greatly magnified. (After Lohmann, in 'Das Tierreich.')

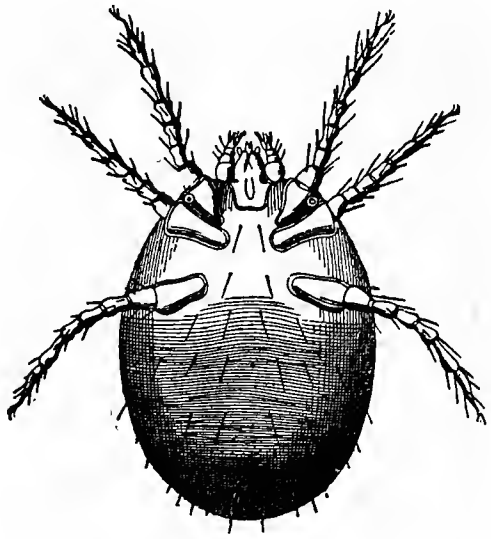


Fig. 774.—*Larva of* Trombidium holosericeum, *ventral surface.* Magnified one hundred times. (After Railliet.)

Family Trombidiidæ.

To the carnivorous section of this family belongs *Leptus autumnalis* (fig. 774), the Harvest Bug. This harvest bug is not an adult, but possibly is the larva of the mite known as *Trombidium holosericeum*. *Leptus autumnalis* is six-legged and brick-red. The legs have six joints and are hairy, and each ends in three slender prongs.

This mite swarms in late summer and autumn on grass and undergrowth, and on such plants as gooseberry, currants, raspberry, beans, from which the pest passes to man, horse, ox, dog, cat, hare, rabbit, mole, and fowls.

Dogs, especially hunting dogs, often harbour the parasites fixed about the head and nose and belly and feet, where the mites cause eruptions. On the cat they give rise to little wounds at the root of the tail and the feet between the claws. Dr Johnston, in the *History of the Berwickshire Naturalists' Club*, quotes a correspondent as to this mite on the horse thus: "In the worst case I have ever seen, that on a horse, the skin seemed exactly as if it had been rubbed with a liquid blister."

Fowls and late-hatched chickens are sometimes much annoyed by the Leptus mites which bury their rostrum at the base of the feathers.

Treatment.—A two per cent solution of carbolic acid is a preventive as well as a cure. Chloroform water—one of chloroform to six of water thoroughly mixed—is also of service. Rubbing in sulphur ointment or benzine or phenic acid will get rid of the mites. In the case of fowls the feathers should be dusted with flowers of sulphur.

Family Sarcoptidæ.

In this family we have the mange or itch mites.

Mange, Itch, or Scab Mites.

These tiny mites have rounded or oval bodies and a conical rostrum. There is a metamorphosis in the life-history.

There are three distinct genera of mange mites—viz., Sarcoptes, Psoroptes,[1] Symbiotes,[2] and under the microscope they are distinguished thus:—

Sarcoptes.	Psoroptes.	Symbiotes.
Body rounded.	Body more ovsl.	Body more ovsl.
A short rostrum and two little expansiona called cheeks.	Rostrum more pointed; no cheeks.	Rostrum about as wide ss long, and blunt; no cheeks.
Legs ahort, not reaching far from the body. The four front legs spring from the edge of the body; the four hind legs sre attsched to the under surfsce of the body snd slmost concesled beneath it.	Lega longer, and sll four pairs csn be seen projecting from the body.	Lega long, and all four pairs visible.
The tarsus (lsst joint of the leg) may bear a long unjointed stslk, terminated in a small sucker or suctorial disc.	The tarsua besrs a three-jointed stalk terminated by a sucker.	The tarsus beara a short unjointed stalk terminsted by a wide sucker.
The mandiblea are nipper-like.	The mandibles are more lance-like.	The mandibles sre nipper-like.
The mites, which are not found in colonies, mine into and make galleries below the skin.	The mites, found many together, do not burrow into the skin, but live in parts sheltered by hair and wool, and under crusts.	The mites, which are socisl, live exposed on the outside of the host.

On the same animal all three kinds of mange mite may be found, but each animal has one species of mite which, of the three, is the most harmful for it. In the following table is indicated various hosts with the genus of mite found on these.

Host.	May be infested by		
Horse . .	Sarcoptes	Psoroptes on the inner side of legs, tail, mane, genital organs.	Symbiotes on fetlock and limbs.
Ox . .	Sarcoptes, perhaps not a species peculisr to it, but derived from some other animsl.	Psoroptes on sides of neck snd root of tail, extending over the body except the limbs.	Symbiotes at root of tail.
Sheep . .	Sarcoptes about the head, and in bad cases to fore-limbs.	Psoroptes (Sheep Scab).	Symbiotes on the feet and limbs.
Dog . .	Sarcoptes.		Symbiotes affects the ears.
Cat . .	Sarcoptes.		Symbiotes affects the ears.
Pig . .	Sarcoptes.		
Goat . .	Sarcoptes on head and body generally.		Symbiotes on sides of neck, back, withers, and loins.
Birds . .	Sarcoptes.		

[1] Psoroptes has, as synonyms, the names Dermatodectes (skin-biters) and Dermatocoptes (skin-wounders).

[2] Symbiotes hss, ss synonyms, the names Chorioptes (hiders) and Dermatophagus (skin-esters).

Except in the case of sheep, where it is the Psoroptic form of mange which is the most serious and most troublesome form, in all the other animals noted the most noxious scab is the Sarcoptic.

Transmissibility of Scab.

Generally speaking, the Sarcopt in each species of host is very contagious for the same species—*e.g.*, Sarcopt of the horse is very readily transmissible to other horses.

Man.—The Sarcopt of man placed experimentally on the horse and dog produced on these an eruption which soon passed off. The same gave no result in the cat.

Horse.—The Sarcopt of the horse passes readily to ass and mule, and is transmissible to man; but the disease set up in man is not severe and yields readily to treatment. It is believed that the Sarcopt of the horse can pass to the ox, but it has not been proved to infect more domesticated animals than those already named.

Psoroptic and symbiotic mange of the horse are not communicable to other animals.

Ox.—Neither the psoroptic nor the symbiotic mange of the ox seems communicable as a permanent disease to the other domesticated animals.

Sheep.—The sarcoptic mange of the sheep passes readily to the goat. Placed experimentally on the horse, ox, and dog, an ephemeral but no permanent disease was produced. The psoroptic mange of the sheep is not communicable to the other domesticated animals.

Dog.—The Sarcopt of the dog is communicable to man. Placed experimentally on the various domesticated animals the results were insignificant or negative.

Cat.—The sarcoptic mange of the cat can infect man. It can pass also to the horse, ox, and dog.

Pig.—The Sarcopt of the pig has been shown to be contagious for man. Placed experimentally on the sheep, cat, and dog there was no result, or only a slight infection which soon passed off.

Goat.—The sarcoptic mange of the goat is transmissible to the horse, ox, sheep, and pig. Experiment has shown that the Sarcopt of the pig can be very troublesome to man, whether man receives it directly from the goat or, secondarily, from one of the just mentioned animals.

Life-History of Mange Mites.

The following round of life of *Sarcoptes scabiei* (fig. 775) may stand as typical of mange mites in general (any exceptions will be noted later).

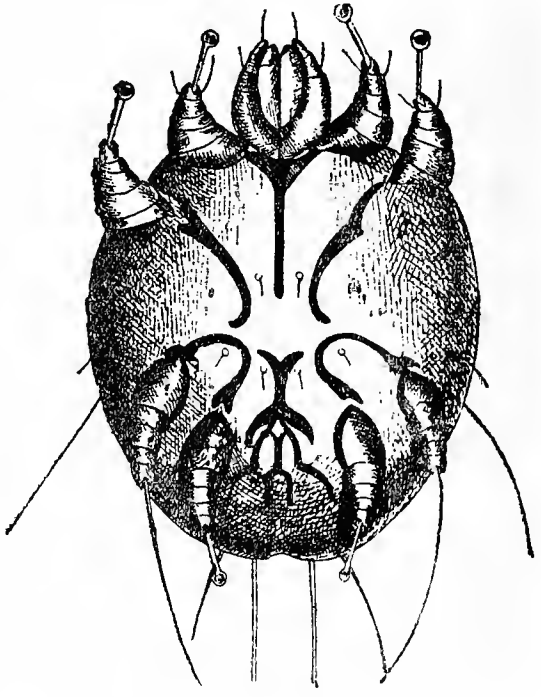


Fig. 775.—*Sarcoptes scabiei.*
Greatly magnified. (After Lohmann, in 'Das Tierreich.')

The fertilised female about to lay her eggs burrows (it has already been pointed out that this is the burrowing genus) into the skin, and makes a gallery along which the eggs are laid one by one. The eggs hatch in a few days, and the larvæ, on hatching, pierce their way to the surface of the skin, where they live for a short time. These newly hatched larvæ are 6-legged and not sexually mature. The larva moults several times

and grows. The next stage is the nymph stage, in which the fourth pair of legs has appeared. In the next stage pairing takes place. Development from the larval to the adult state is rapid, and the numbers of the pests soon increase.

Sarcoptes scabiei var. equi.

This mange mite, in its attack on the horse, generally starts about the withers, the place of attack being marked by a few hard pimples on the skin. As the disease spreads, neck, shoulders, back, and sides may be invaded, long-haired parts (which would, on the other hand, be chosen by the Psoroptes of the horse) being avoided. Characteristic of attack is an intense itching, the itching being worst at night and in warm conditions; greater in the stable than when the horse is exposed, and greater when the horse is covered with a cloth than when naked. Pimples form, and can be felt as little elevations if the hand be pulled across the skin: these burst when the horse rubs itself, and the secretion from them dries into a crust. To begin with, these crusts are isolated, but as the disease spreads different patches run together and a large crust is formed, under cover of which the young mites may be found. The hair also drops out, and the skin wrinkles and thickens. Care must be exercised against the spread of the disease. The pest spreads easily from horse to horse. The chief agents in the transmission are the larvæ, the nymphs, the newly fertilised females, and the males,—all these being found more towards the external surface. An attacked horse should be isolated. Common means of infection are the brushes, curry-combs, and instruments used in dressing the horse; while the stall where the patient is housed is a source of danger until disinfected.

Scaly Leg of the Fowl (Sarcoptes nutans).

This mite lives underneath the epidermal scales of the legs of the fowl; it also affects and is contagious for turkeys, pheasants, partridges, parroquets, and small cage-birds.

There are slight differences in the structure and mode of life of this Sarcoptes as compared with the preceding general account. First of all, the species seems to be viviparous; then while the male has the legs provided with the usual stalks and suckers, the legs of the female are usually short, and quite lack the bristles and suckers. Again, the female simply burrows into the skin without proceeding to form the little tunnel or gallery described as characteristic for the genus Sarcoptes.

The ripe female is very sluggish, scarcely moving, so that the disease is spread by the males, larvæ, and nymphs, which move about more on the outside of the skin. The progress of the disease is slow; there is a comparatively slight itching; also an elevation of the epidermal scales, chiefly those in front of the ankle and above the toes. Below these scales is a powdery mass glued into a crust by a serous exudate, the whole ultimately forming irregular thick crusts which, if broken off, leave the skin below exposed and bleeding. On the under surface of these crusts is a number of little pits; each of such pits has been the abode of an egg-laying female.

The diseased birds are lame; they have a difficulty in perching, and there is a great falling off in their condition.

Treatment.—Separate mite-infested birds. Thoroughly cleanse and disinfect the places where the birds have been kept with boiling water and whitewash. As to the affected bird itself, the general plan is to soften the crusts by bathing the leg in hot water and then carefully to remove them; then apply a mixture of creasote 1 part and lard 20 parts. Or use a mixture of equal parts of flowers of sulphur and vaseline. The removal of the crusts is often attended with a bleeding, and therefore some prefer to remove only the crusts that are already somewhat loose and are easily removed. After a day or two the dressed limb should be cleansed with soap and water.

Feather-Eating or Depluming Scabies (Sarcoptes lævis).

This is a very contagious and a quickly spreading disease on fowls and pigeons, and is often due to a tiny Sarcopt at the roots of the feathers. The disease is most prevalent in spring and summer. Beginning at the rump, it

spreads to other parts of the body, the neck and head being often badly infected. The feathers break off and fall away at the attacked places, and the birds, irritated by the mites which live at the base of the feathers, pull out their feathers. The suffering birds become thin and fall away in their egg-laying.

Affected birds—the cock especially—should be isolated. The creosote and lard ointment mentioned above is excellent, as also is oil of cloves rubbed well in.

COMMON SHEEP SCAB (*Psoroptes communis var. ovis*).

This mite is large enough to be visible to the naked eye, the full-grown male $^1/_{50}$ inch and the female $^1/_{40}$ inch. The egg measures $^1/_{120}$ inch. The larvæ from

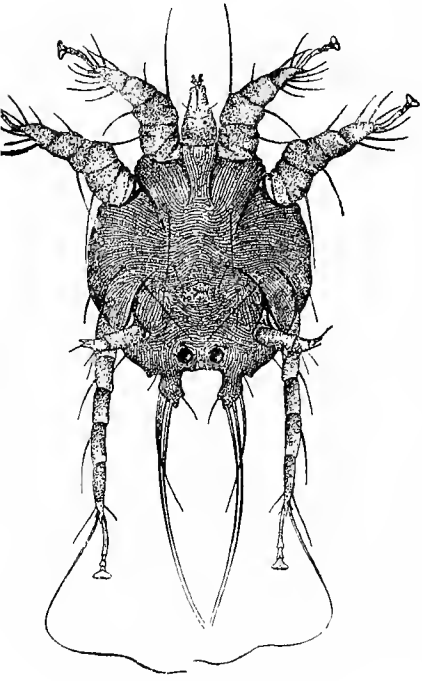


Fig. 776.—*Adult male of* Psoroptes communis *from under surface.*
(After Salmon and Stiles.)

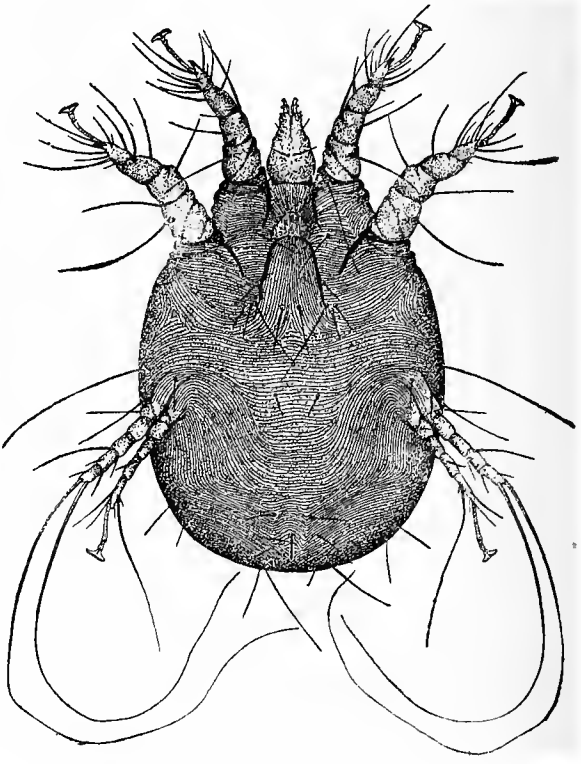


Fig. 777.—*Adult female of* Psoroptes communis *from under surface.*
(After Salmon and Stiles.)

the eggs have only six legs. The adult male (fig. 776) has two abdominal projections which end in long hairs. Each of the six front legs of the male has a stalk ending in a sucker; the two hind legs are small and have neither stalk nor sucker. The legs of the female (fig. 777) differ in appearance before the last moult and after the last moult. Before the last moult only the front four legs have stalk and sucker; the hind two pairs end in hairs. After the last moult the stalk and sucker are present on the two front pairs of legs and on the fourth pair, but the third pair of legs remains without stalk or sucker.

The Psoropt is found, not burrowing into the skin and laying its eggs in a gallery like the Sarcopt, but living externally on the skin, and laying eggs on it or glueing them to the wool near the skin. The parts chosen for infesta-

tion are those where the wool is thick—the back, flank, rump, and neck. The six-legged larva hatches from the egg, and the further changes resemble these described above for *Sarcoptes scabiei.*

Symptoms and Result of Attack.—The sheep are restless, and bite and rub themselves against posts, fences, &c., in order to relieve the intense itching that is occasioned by the mites pricking the skin. Little pimples appear as the result of the woundings, and from them there is an exudation of matter; the exudate dries into a crust. The sheep in scraping themselves rub off little pieces of crust and tufts of wool. The area of infection goes on increasing. If material be wanted for microscopic examination it is best procured from the edges of the crusts.

The best method to adopt in order to demonstrate the pest is to make a scraping of a newly formed crust or near the edge of a crust; this should then be placed in a solution of potash and allowed to lie for some time, the material being afterwards placed for examination under the microscope.

From the life-history of this pest care must be taken to avoid the spread of the disease by preventing infection to hitherto clean and healthy sheep. Therefore, yards and sheds that have contained scabby sheep should be thoroughly cleaned and disinfected and allowed to stand empty for a month before being used again for clean sheep. Any posts on the pasture-grounds used for rubbing should be whitewashed, as tags of wool or bits of crust sticking to them may harbour some of the parasites. Hence the danger also to clean sheep passing along a highway were scabby sheep allowed to make use of the highway.

Treatment.—The great method of fighting this Psoropt is by dipping. There is a large number of effective dips on the market, some of them arsenic dips. The Board of Agriculture, while recognising the efficacy of others, mentions the three following:—

Lime and Sulphur Dip.

Mix 25 lb. of flowers of sulphur with 12½ lb. of good quicklime. Triturate the mixture with water until a smooth cream without lumps is obtained. Transfer this to a boiler capable of boiling 20 gallons, bring the volume of the cream to 20 gallons by the addition of water, boil and stir during half an hour. The liquid should now be of a dark-red colour; if yellowish, continue the boiling until the dark-red colour is obtained, keeping the volume at 20 gallons. After the liquid has cooled, decant it from any small quantity of insoluble residue, and make up the volume to 100 gallons with water.

Carbolic Acid and Soft-Soap Dip.

Dissolve 5 lb. of good soft-soap, with gentle warming, in 3 quarts of liquid carbolic acid (containing not less than 97 per cent of real tar acid). Mix the liquid with enough water to make 100 gallons.

Tobacco and Sulphur Dip.

Steep 35 lb. of finely-ground tobacco (offal tobacco) in 21 gallons of water for four days. Strain off this liquid and remove the last portions of the extract by pressing the residual tobacco. Stir the mixture well to secure an even admixture, and make up the total bulk to 100 gallons with water.

The period of immersion in these dips should not be less than half a minute.

In Leaflet No. 61 of the Board of Agriculture it is stated that of the two forms of baths—hand and swimming—the latter is greatly to be preferred. Its advantages are: "(1) The sheep being in a natural position may be completely immersed, even in a poisonous solution, with comparatively little danger; (2) sheep in lamb may be dipped with much less risk; (3) the motion of swimming allows no portion of the fleece to escape contact with the solution; (4) the work is most easily and therefore most effectively performed; (5) a larger number of sheep can be dipped in a given time and with fewer operators."

TICKS (*Ixodoidea*).

The Ixodidæ (Warburton), Ixodinæ (Neumann), are mites with a terminal rostrum made of mandibles and maxillæ, as in the previous families, but modified in a different way. Parts of the two maxillæ are soldered together to form a so-called dart furnished with backwardly-

directed hooks. The other parts of the maxillæ—viz., the maxillary palps—are 4-jointed. The two mandibles complete the rostrum; each has a basal stem and a branched hooked upper part. It is by means of this rostrum that ticks fix themselves so firmly to their hosts; the recurved hooks of the rostrum make it difficult or impossible for one to pull, by main force, a tick from its attachment. In so pulling the body may come away and the mouth-parts be left in the wound.

The legs end in two claws and a little sucker. The skin is leathery but extensible, and a protective dorsal shield is present. Breathing is by tracheæ, which open in spiracles at the bases of the hind pair of legs. The two sexes differ in size, the male being smaller. They also differ in the character of the dorsal shield, which in the male may cover the greater part of the dorsal surface, whereas in the female it is limited to a small region at the front part of the cephalothorax.

Life-History.

In the life-history there is a metamorphosis, there being four stages—adult, egg, larva, nymph. The fertilised female, gorged with blood, drops away from the animal to which it has been fixed and proceeds to lay its eggs. The number of eggs is great, and the egg-laying may be spread over a considerable time, varying with the weather conditions.

From the eggs hatch tiny forms with six legs. These young forms ascend blades of grass or collect at the tip of a twig or branch, and here with marvellous patience they wait until a host passes. The host is clutched at with outstretched fore-legs, and having successfully obtained a lodgment, the larvæ fix themselves and remain for a time, feeding at the expense of the host. After feeding for some time, the larva withdraws its rostrum and drops voluntarily to the ground. Here it remains passive, until at last it undergoes the first moult; the skin ruptures and the nymph appears.

The nymph has a stronger rostrum and longer and stronger legs than the larva. The legs, too, are now eight in number. Spiracles are also present for the first time. Sexual organs are not completely developed. The nymph, like the larva, seeks a host, and attachment is followed by a period of feeding. There is then a similar falling away of the nymph from the host, followed by another moult. As a result of this moult we have the mature ticks, male and female. When these have fixed themselves to a host pairing takes place. The male does not die after one act of copulation, but is able to proceed to other efficient acts of pairing. The mature male on the host feeds, but does not swell much; the female, on the other hand, rapidly increases in size, and at last falls away and prepares for her egg-laying.

There are some species of tick in which, once the larva has reached a host, there is no leaving of the host until the female falls off for her egg-laying: in such cases the moults take place while the larva and nymph remain attached to the animal.

BRITISH TICKS.

The following species are given by Wheler[1] as having been found on one or other of the domesticated animals:—

Ixodes ricinus (Latreille): male 2.35 mm. to 2.80 mm. long, and the female from about 3 mm. when fasting to 10 mm. long when replete. Found on numerous hosts, the favourite seeming to be sheep, goats, cattle, and deer; found also on hedgehogs, moles, bats, and even on birds and lizards.

Ixodes hexagonus (Leach) *var. longispinosus:* male, 2.50 to 3 mm. long; female, 3.00 mm. fasting to 11 mm. when replete. Found especially on stoat, ferret, hedgehog, but also on sheep and cattle.

Ixodes hexagonus (Leach) *var. inchoatus:* male, 2.52 mm. long; female, 2.86 mm. fasting to 6.56 mm. replete. Found abundant on shepherds' dogs on the Border; was never found on the sheep.

Hæmaphysalis punctata (Canestrini and Fanzago): male, 3.10 mm. long; female, 3.44 mm. fasting to 12 mm. when replete. Found on sheep, especially behind the ears,

[1] "British Ticks," by Edward Galton Wheler, in *The Journal of Agricultural Science*, March 1906.

and on goats, cattle, horses; also on the hedgehog.

Dermacentor reticulatus (Fabricius): male, 4.20 mm. long; female, 3.86 mm. fasting to 16 mm. when replete. On sheep occasionally, but also attacks cattle, deer, goats, and even man.

Very much work still remains to be done on ticks;[1] the actual workers at the family are not numerous, but interest has been greatly stimulated owing to the recognition of the very important part which ticks may play in the spread of grievous diseases. There are numerous pathogenic ticks, and the following diseases are known to be carried by them, the tick being the intermediate host by which the parasite causing the disease is introduced to the suffering animal:—

Red Water or Texas Fever in cattle.
Heart Water in sheep and goats.
Canine Piroplasmosis or Malignant Jaundice.
Rhodesia or Coast Fever in cattle.
Carceag or Piroplasmosis in sheep.

FAMILY GAMASIDÆ.

To this family belongs the Hen Mite (*Dermanyssus gallinæ*). This is an oval, pear-shaped mite which varies in colour from white to red, according as it is fasting or replete with blood. The legs are strong and bristly; the body is somewhat flattened, the hind part being widest; the abdomen is surrounded with bristles. The mites live in colonies in hen-houses and pigeon-lofts, the colony containing all stages at the same time—larvæ, nymphs, males, females. These hen mites are temporary parasites, hiding in the day-time in crevices and such shelter-places, whence they issue at night and swarm on to the birds, making rest impossible for them. The birds are irritated by the itching which is an accompaniment of the wounding made by the mites' mouth-parts. The pests suck the blood, and what makes them more formidable is their ability to subsist for a long time in absence of a live host. Brood hens are worried, and young birds become anæmic and may die. The mite may also invade the nostrils and external auditory meatus. In addition to attacking the hen and the pigeon, this *Dermanyssus* (skin-pricker) pricks man, the horse, dog, cat, and goat. Horses, like fowls, are attacked at night, and the irritation causes an eruption of small vesicles. From continual rubbing these get broken, the skin becomes raw, and little scabs result.

Treatment.—Do not allow fowls into the stables at night. Bathe with a 5 per cent solution of chlorhydrate of ammonia. To keep fowls free from the mite let there be a regular cleansing and disinfection of their houses and perches.

[1] At present an excellent Monograph of the Ixodoidea is being published. The authors are George H. F. Nuttall, M.A., M.D., Ph.D., D.Sc., F.R.S.; Cecil Warburton, M.A., F.L.S.; W. F. Cooper, B.A., F.L.S.; and L. E. Robinson, A.R.C.Sc. (London).

AILMENTS OF FARM LIVE STOCK.

It is not presumed that the farmer should become so familiar with veterinary science as to be able to dispense with the services of the professional Veterinary Surgeon. The farmer, however, should unquestionably know enough of the ailments which afflict his live stock to enable him to recognise the symptoms of each when he sees them, and also to successfully treat those of the more simple kind, as well as to decide when the veterinary surgeon should be sent for, and what had best be done until he arrives. The information necessary for these purposes will be found, carefully classified, in the following treatise. This treatise, compiled originally by Mr G. H. C. Wright, LL.B., and edited by Mr F. Tonar, M.R.C.V.S., has been carefully revised for this edition of *The Book of the Farm* by a Fellow of the Royal College of Veterinary Surgeons, who is one of the most experienced and trusted members of the veterinary profession.

SUBJECTS.

	PAGE
HORSES	438
CATTLE	466
SHEEP	484
SWINE	490
DOGS	493
RECIPES	493
Abortion (cows)	478
—— (ewes)	488
Abrasion, an	459
Abscesses	468
Acute founder	462
Administering medicine	496
After-birth	481
Amaurosis or glass eye	442
Amputation of the tongue (horse)	446
Anthrax or splenic apoplexy (cattle)	468
—— (swine)	490
Apoplexy or staggers (horse)	438
—— (sheep)	484
Arsenic-poisoning (horse)	455
—— (cattle)	477
Ascites. See Dropsy of the abdomen	476
Back tendons, sprain of the	460
—— racking	497
—— weak	489
Bandaging. See Note in rupture of suspensory ligament	458
Bastard strangles	445
Black-quarter or quarter-ill	468
—— water. See Red water	478
Bladder, inflammation of	453
—— neck of	453
—— stone in the	455
Bladders, tongue	446
Bleeding (horse)	448
—— (cattle)	478
—— from nose (horse)	445
Blindness	484
Blistering. See Firing	465
Blood, staling of	455
Bloody flux. See Dysentery	475
—— milk	480
Bog-spavin	459
Bone-spavin	458
Bots	451
Bowels, inflammation of the (horse)	452
—— (cattle)	476
—— twist of the	453
Brain fever	439
—— inflammation of the (horse)	439
—— (cattle)	466
—— water on the	485
Braxy or sickness	486
Broken knees	456
—— horns	468
—— ribs (horse)	448
—— wind	447
Bronchitis (horse)	446
—— (cattle)	471
Brushing, cutting or	456
Bull-burnt or gonorrhœa	479
Calculus. See Stone in the bladder (horse)	455
—— (sheep)	486
Calf-bed, falling down of the	479
Calves, destroying horns in	467
—— special diseases of	483
Calving. See Parturition	481
Cancer of the tongue (cattle)	467
Canker	462
Capped hocks	456
—— elbow	456
Castration	497
Cataract	442
Catarrh. See Cold (cattle)	469
—— (sheep)	485
—— epizootic. See Influenza	471
—— malignant. See Murrain	472
Catarrhal fever. See Distemper	448
Cattle plague or rinderpest	469
Chest, dropsy of	448
Choking (horse)	447
—— (cattle)	469
Cholera, hog. See Swine-fever	491
Chronic cough	447
—— constipation	452
—— founder	463
Cleansing, removing	481
Coffin-joint, sprain of the	460
Cold (common) horse	447
—— (cattle)	469
Colic or gripes (horse)	451
—— (cattle)	474
—— flatulent (horse)	451
—— simple (cattle)	474
—— spasmodic (horse)	451
Constipation (horse)	452
—— (cattle)	474
—— (calves)	483
—— (sheep)	486
Consumption. See Tuberculosis	472
Contraction of the foot	462
Contused wounds	459
Convulsions	490
Corns	462
Costiveness or fardel-bound	474
Cough, chronic (horse)	447
—— teething (horse)	446
—— (cattle)	470
Cow-pox	479
Cracked heels. See Grease	457
Cramp	491
Crib-biting	447
Cud, loss of	477
Curb	456
Cut, speedy	459
Cutting or brushing	456
Destroying horns in calves	467
Diabetes	452
Diarrhœa (horse)	452
—— (cattle)	475
—— (calves)	484
—— (sheep)	487
—— (swins)	490
Dishorning and broken horns	467
Dislocation or luxation of the patella	461
Distemper	448
Docking	498
Dropsy of the chest	448
—— abdomen	476
—— womb	481
Dunt. See Staggers	485
Dysentery (horse)	452
—— (cattle)	475
—— (sheep)	487
Elbow, capped	456
Enemas (injections)	497
Enlarged knees	482
Enlargement of the hock	456
Epilepsy or fits	439
Epizootic catarrh. See Influenza	471
—— lymphangitis	439
Erysipelas	490
—— (swine)	492
Extracting teeth	445
Eye, glass	442
—— inflammation of the (horse)	442
—— (cattle)	468
—— wounds in the	443
Eyeball, growth on	468
—— removal of the	442
Eyelids, tumour or itching of the	442
—— inflammation of the, or ophthalmia (horse)	442
—— —— (cattle)	468
—— warts on the	443
Falling down of the calf-bed	479
False quarter	462
Farcy	443
Fardel-bound or costiveness	474
Feet, foul or fouls in the	482
—— pumiced	463
Felon chine. See Rheumatism (cattle)	482
Fern-sick. See Staggers	485
Fetlock, sprain of the	460
Fever, catarrhal. See Distemper	448
—— milk	481
—— mud	461
—— parturient	488
—— rheumatic	447
—— scarlet	449
—— simple	448
—— swine	491
Firing	465
Fistulous withers	451
Fits. See Epilepsy	439
Flatulent colic (horse)	451
—— (cattle)	474
Flooding after calving	479
Flukes in liver	477
Foaling	453
Fomentation	497
Foot, contraction of the	462
—— foul or fouls in the	482
—— inflammation of the	462
—— rot (sheep)	489
—— weakness of the	465
Foot-and-mouth disease (cattle)	470

Foreign bodies in the rumen 475
Foul or foule in the feet . 482
Founder, acute . . . 462
—— chronic . . . 463
Fractures 457
—— of the nose and jaw . 440
—— of the skull . . 440

Galls, saddle . . . 450
—— wind 462
Gall-stones . . . 486
Garget (cattle) . . . 479
—— (sheep) . . . 488
Gargle. See Murrain . 472
Gastritis or inflammation of stomach . . . 453
Glanders 443
Glass eye 442
Gleet, nasal . . . 444
Gogglee. See Staggers . 485
Gonorrhœa or bull-burnt . 479
Grain-sick . . . 475
Grass staggers . . . 442
Grease 457
Gripes. See Colic (horse). 451
—— —— (cattle) . . 475
Growth on eyeball . . 468
Gullet, stricture of . . 451
Gut tie . . . 476

Hard udder . . . 480
Haw, thickening of the . 443
Heart disease . . . 450
Heaving. See Parturient fever 488
Hefting or overstocking . 480
Hernia, scrotal . . . 455
—— umbilical . . . 455
Hide-bound . . . 465
Hip knocked down . . 458
—— sprain of . . . 460
Hock, enlargement of the . 456
Hocks, capped . . . 456
Hog cholera. See Swine-fever 491
Hoose or husk (cattle) . 471
—— (sheep) . . . 485
—— (swine) . . . 490
Hoove, hove, or hoven (cattle) 475
—— (sheep) . . . 487
Horns, broken . . . 468
—— destroying, in calves. 467
—— dishorning and broken 467
Hydrophobia . . . 493

Impaction of the paunch . 475
Incised wounds . . . 459
Inflammation of the bladder 453
—— neck of the bladder . 453
—— bowels (horse) . . 452
—— —— (cattle) . . 476
—— brain (horse) . . 439
—— —— (cattle) . . 466
—— eye (horse) . . 442
—— —— (cattle) . . 468
—— eyelids (horse) . . 442
—— —— (cattle) . . 468
—— foot 462
—— jugular vein . . 449
—— kidneys (horse) . . 453
—— —— (cattle) . . 476
—— liver (horse) . . 454
—— —— (cattle) . . 477
—— —— (sheep) . . 487
—— lungs or pneumonia (horse) 449
Inflammation of lungs (cattle) 471
—— —— (sheep) . . 485
—— —— (swine) . . 491
—— muscles of the neck . 450
—— stomach (horse) . 453
—— —— fourth (cattle) . 476
—— —— (sheep) . . 487
—— udder. See Garget (cattle) 479
—— —— (sheep) . . 488
—— womb (mare) . . 454
—— —— (cow). . . 480
Influenza. See Distemper (horse) 448
—— or epizootic catarrh (cattle) 471
Intestinal worms . . 492
Itch. See Mange . . 465
Itching or tumour of the eyelids 442

Jaundice or yellows (horse) 454
—— (cattle) . . . 477
—— (sheep) . . . 488
Jugular vein, inflammation of 449

Kidneys, inflammation of the (horse) . . . 453
—— (cattle) . . . 476
Knees, broken . . . 456
—— enlarged . . . 482
Knee-tied 458

Lacerated wounds . . 459
Lameness 491
Laminitis—founder (acute) 462
—— —— (chronic) . . 463
Lampas 444
Lead-poisoning . . . 455
—— (cattle) . . . 477
Legs, swelled . . . 461
Leucorrhœa or the whites 480
Lice (horse) . . . 465
—— (cattle) . . . 482
—— (sheep) . . . 490
—— (swine) . . . 493
Ligament, rupture of the suspensory . . . 458
Lip, lower, paralysis of . 446
Liver, inflammation of the (horse) 454
—— (cattle) . . . 477
—— (sheep) . . . 487
—— (flukes) . . . 477
Lockjaw or tetanus (horse) 440
—— (cattle) . . . 467
—— (sheep) . . . 484
Lose of cud . . . 477
Louping-ill or trembles . 484
Lumbago. See Rheumatism 482
Lunge, inflammation of the (horse) 449
—— (cattle) . . . 471
—— (sheep) . . . 485
—— (swine) . . . 491
Lymphangitis, epizootic . 439

Mad staggers . . . 439
Maggots. See Vermin . 490
Malignant catarrh . . 472
Mallenders and sallenders 458
Mange (horse) . . . 465
—— (cattle) . . . 482
—— (sheep). See Sheep-scab 489
Measles (swine) . . 491
Megrims 441
Mercury-poisoning . . 477
Milk-fever . . . 481
Mouth, thrush in the . 466
—— wounds in the . . 446
Mud-fever 461
Murrain 472

Nasal gleet . . . 444
Navel-ill 484
Navicular joint disease . 463
Nettle-rash or surfeit . 466
Nose, bleeding from . . 445
Nursing the sick . . 499

Open joints . . . 457
Ophthalmia (horse) . . 442
—— (cattle) . . . 468
Optic nerve, palsy of the . 442
Over-reaching . . . 463
Overstocking or hefting . 480
Ox, contagious pleuro-pneumonia of the . . 472

Palsy or paralysis . . 441
—— of the optic nerve . 442
Paralysis. See Palsy . 441
—— of lower lip . . 446
—— of the tongue . . 446
—— (cattle) . . 466
Partnrient fever . 488
Parturition or foaling . 453
—— or calving . . . 481
Patella, dislocation or luxation of the . . . 461
Peritonitis. See Inflammation of the bowels (horse) 454
Pink eye. See Distemper 448
Plague, swine . . . 492
Pleurisy 449
Pleuro-pneumonia of the ox 472
Pneumonia. See Inflammation of the lungs (horse) 449
—— (cattle) . . . 471
—— (sheep) . . . 485
—— (swine) . . . 491
Poison (horse) . . . 454
—— (cattle) . . . 477
Poll evil 450
Polypus 445
Polyuria, diabetes or . 452
Poulticee 497
Pregnancy, time of . . 499
Pricks or wounds in the sole 463
Prolapse of the rectum (horse) 455
—— —— (swine) . . 491
Pulse 499
Pumiced feet . . . 463
Punctured wounds . . 459
Purpura 449

Quarter, false . . . 462
Quinsy 470
Quittor 464

Rabies. See Hydrophobia 493
Recipes (horses) . . 493
—— (cattle) . . . 495
—— (sheep) . . . 495
Rectum, prolapse of the (horse) 455
—— —— (swine) . . 491
Red water. . . . 478
Removal of the eyeball . 442

Respiration . . . 499
Rheumatic fever . . 447
Rheumatism (horse) . . 458
—— (cattle) . . . 482
—— (swine) . . . 491
Rhododendron-poisoning . 477
Ribs, broken . . . 448
Rickets 489
Rinderpest. See Cattle plague 469
Ringbone 464
Ringworm (horse) . . 466
—— (cattle) . . . 483
Roaring 450
Rot 488
—— foot (sheep) . . 489
Round bone, sprain of . 460
Rumen, foreign bodies in the 475
Rupture of suspensory ligament . . . 458

Saddle galls . . . 450
Salleuders and mallenders 458
Sand-crack . . . 464
Scarlet fever . . . 449
Scrotal hernia . . . 455
Seedy toe 464
Setoning 498
Shab. See Sheep-scab . 489
Sheep-pox or Variola ovina 486
—— scab 489
—— ticks. See Vermin . 490
Shoulder slip . . . 460
—— sore 450
—— sprain of . . . 460
Sickness. See Braxy . 486
Side-bones . . . 464
Simple colic . . . 474
Sitfasts 450
Skull, fracture of . . 440
Sole, pricks or wounds in the 463
Sore shins 460
—— shoulders . . . 450
—— teats 482
—— throat (horse) . . 447
—— —— (cattle) . . 470
Spasmodic colic . . 451
Spavin, bone . . . 458
—— bog 459
Spaying 498
Speedy cut 459
Splenic apoplexy. See Anthrax 468
Splint 460
Sprain of the back tendons 460
—— coffin-joint . . 460
—— fetlock . . . 460
—— round bone . . 460

Sprain of the shoulder . 460
—— stifle-joint . . . 461
Staggers. See Apoplexy (horse) 438
—— (sheep) . . . 485
—— (grass) . . . 442
—— mad (horse) . . 439
—— stomach . . . 441
Staling of blood . . 455
Stifle-joint, sprain of the . 461
Stomach, inflammation of (horse) 453
—— (sheep) . . . 487
—— fourth (cattle) . . 476
—— staggers . . . 441
Stone in the bladder (horse) 455
—— (sheep) . . . 486
Straining. See Parturient fever 488
Strangles 445
—— bastard . . . 445
Stricture of gullet . . 451
String-halt . . . 461
Sturdy. See Staggers . 485
Suppression of urine . . 482
Surfeit (horse) . . . 466
—— (swine) . . . 491
Suspensory ligament, rupture of 458
Swelled legs . . . 461
Swine erysipelas . . 492
—— fever . . . 491
—— plague . . . 492

Teats, sore . . . 482
—— warts on . . . 480
Teeth, diseases of . . 445
—— extracting . . . 445
Teething cough . . . 446
Temperature . . . 499
Tetanus. See Lockjaw (horse) 440
Tetanus. See Lockjaw (cattle) 467
—— (sheep) . . . 484
Thick wind . . . 451
Thickening of the haw . 443
Thoroughpin . . . 461
Throat, sore (horse) . . 447
—— (cattle) . . . 470
Thrush 464
—— in the mouth . . 466
—— referred to in canker. 462
Toe, seedy . . . 464
Tongue, amputation of . 446
—— bladders . . . 446
—— cancer of . . . 467
—— paralysis of . . 446

Tongue, wounds of . . 446
Trembles or louping-ill . 484
Trichinosis . . . 492
Tuberculosis—consumption 472
Tumours in the brain . 439
—— of the eyelids . . 442
—— (horse) . . . 458
Turn-sick. See Staggers . 485
Twist of the bowels . . 453

Udder, hard . . . 480
—— inflammation of the. See Garget (cattle) . . 479
—— —— (sheep) . . 488
Umbilical hernia . . 455
Urine, suppression of . 482

Variola ovina. See Sheep-pox 486
Vermin 490

Warbles (cattle) . . 483
Warts on the eyelids . 443
—— teats 480
Water, black. See Red water 478
—— on the brain . . 485
Weak back. See Rickets . 489
Weakness of the foot . 465
Whistling and wheezing . 431
White skit . . . 484
Whites, leucorrhœa or the 480
Wind, broken . . . 447
—— thick. . . . 451
Wind-galls . . . 462
Withers, fistulous . . 451
Womb, inflammation of the (mare) 454
—— (cow). . . . 480
—— dropsy of the . . 481
Worms (horse) . . . 455
—— intestinal (swine) . 492
Wounds (horse) . . 459
—— (cattle) . . . 483
—— contused . . . 459
—— of the coronet . . 464
—— in the eye or eyelids . 443
—— incised . . . 459
—— lacerated . . . 459
—— mouth . . . 446
—— punctured . . 459
—— sole 463
—— tongue . . . 446

Yellows. See Jaundice (horse) . . . 454
—— (cattle) . . . 477
Yew-poisoning . . . 477

HORSES.

DISEASES AFFECTING THE HEAD, EYES, MOUTH, AND NERVOUS SYSTEM.

I.—THE HEAD AND NERVOUS SYSTEM.

Apoplexy or Staggers.

This almost hopeless disease results from an effusion of blood producing pressure on the brain.

Symptoms.—Head carried low. The horse staggers till he falls. Eyes fixed and pupils dilated. Muzzle cold. Hearing and sight affected. Teeth clenched. When convulsions come on, the horse soon dies.

Cause.—Apparently the breaking of a small blood-vessel on or near the brain, occasioned by the derangement of the system from overfeeding, or by violence.

Prevention.—There is practically no means of prevention beyond the ordinary proper management of the animal.

Treatment.—Apply iced or cold water in a douche or stream along the spine and on the back of the head. Give a physic ball (No. 17). Remove dung from lower intestines with the hand, and the urine may require to be removed by the catheter. Administer a warm clyster (No. 13) two or three times a-day, and if it can be done without disturbing the animal too much, give the following every four hours: Bromide of potassium, 4 drs.; brandy, 6 oz.; water, 8 oz. But perfect quietness is the best medicine. Nothing more can be done: this almost invariably fatal disease must be left to take its course.

Tumours in or on the Brain

can seldom, if ever, be recognised and localised during life, and their treatment is practically hopeless.

Brain-fever, Mad Staggers, or Inflammation of the Brain.

Symptoms.—Sleepy and daft condition. Nostrils distended. Flanks heaving. Eye wild. When delirium comes on, the horse becomes violent and dangerous: his struggles will continue till he is exhausted, and the stupor returns.

This disease is sometimes thought to be colic: the difference is, however, very apparent. In colic, the horse is conscious, and only plunges and rolls from pain, often turning his head round to his flanks: in mad staggers the struggles are more violent, and consciousness is lost.

Cause.—Fulness of blood to the head through being over-heated in hot weather.

Treatment.—This disease is so often fatal, and so little can be done to check it by medicine, that bleeding seems the only course to pursue.

Put the horse in a cool stable. Open the jugular vein, and bleed till he is weak.

Give purgative—croton-nut, ½ dr., or croton-oil, 20 drops, in warm gruel, and repeat in 10 gr. doses, or croton-oil 10-drop doses every eight hours till the bowels are open.

Bathe head with iced or cold water. Inject warm water and soap. After purgative has been administered, give every few hours, in gruel, a draught containing chloral hydrate, 4 drs.; bromide of potassium, 4 drs.; Fleming's tincture of aconite, 5 drops; spirit of chloroform, 1 oz.

When recovering, feed moderately for a few days on bran-mashes and a little hay.

Epilepsy or Fits.

A disease of the brain not very common among horses.

Symptoms.—Attack is sudden. Horse stares round, trembles, and falls to the ground. Convulsions more or less severe follow.

When consciousness returns, the horse will feed as if nothing happened.

Cause.—A derangement of the brain; but very little is known about it, and there are no known means of prevention or cure.

A horse subject to these fits is dangerous for either riding or driving.

Treatment.—Give a purgative (No. 17), and if the horse is restless or excitable give a draught composed of chloral hydrate, 4 drs.; tincture of belladonna, 1 oz.; water, 8 oz., morning and evening. Little can be done to guard against a return of this disease.

Epizootic Lymphangitis.

A contagious and eruptive disease affecting horses and mules, and, although less liable to it, the ox sometimes becomes affected. Its first appearance in Britain was in horses brought from South Africa after the war. It is now (1909) believed to be stamped out.

Cause.—It is due to a fairly large, somewhat ovoid, micro-organism, the *Cryptococcus farcinimosus*, possessed of considerable vitality, and the disease is easily communicated from affected to healthy animals.

Symptoms.—Small nodules form on the head, neck, legs, or on any part of the body. They may grow as large as hazel-nuts, burst in succession, and discharge matter. The sores formed have little tendency to heal, and proud flesh may grow from the wounds, forming large ulcers. The lymphatic vessels in their neighbourhood become inflamed, swollen, and stand out like cords. Ulcers may form in the nostrils, but this is not common, although there is often a dis-

charge from one or both nostrils, and enlargement of the glands under the jaw. Unless energetically treated at an early stage, gradual emaciation leads to exhaustion and death.

Treatment.—The best treatment is the complete excision of the diseased part — the ulcers — opening up of the inflamed lymphatic vessels, and the destruction of the diseased tissues with caustics or the hot iron. It should be left to the veterinary surgeon.

Prevention. — Isolation of affected animals, the free use of antiseptics, careful burial or cremation of diseased carcases, and the thorough cleansing and disinfection of the boxes or stables.

Fracture of the Skull.

The bones of the skull are so thick that a fracture can only arise from a fall when a horse rears, or else from brutal violence. This is a common occurrence with pit ponies, and is caused by their knocking their heads against the roof timbers. In most pits they wear a leather skull-cap to prevent this. It is generally fatal.

Treatment. — The parts should be elevated and fastened with adhesive plasters, to prevent their moving. To reduce any inflammation, give purgative (No. 18) and a spare diet.

Fracture of the Nose

is caused by a fall, or a blow across the bones of the nose.

Treatment.—Place the finger up the nose, and gently push the bones back into their place, and retain them there by an adhesive plaster.

Fracture of the Jaw.

Generally caused by a kick, fall, or accidental violence.

Treatment.—If the animal is of any value, get the jaw set by a veterinary surgeon, who will place it in a cradle made for that purpose.

Lockjaw or Tetanus.

A disease affecting the nervous system, and one of the most fatal which attacks the horse.

Symptoms.—A difficulty in chewing its food and some stiffness about the jaws is often the first symptom observable. Water is gulped down, the jaw becomes rigid, and saliva runs from the mouth. Afterwards the muscles of the head, neck, and shoulders become fixed, till the whole muscular system of the body seems cramped. After some days, if the disease is not checked, the horse will die in agony from sheer exhaustion.

Cause.—It is now believed to be contagious, and due to a micro-organism—the bacillus of Nicolaïer, or drumstick bacillus; but the apparent cause is generally some wound, kick, or blow. Docking has been known to cause it. In some cases the only apparent cause has been the existence of bot-worms in the stomach. Exposure to cold and general neglect have also brought it on.

Prevention.—There is no particular means of prevention beyond the proper care of the animal, and maintaining thorough cleanliness of any wound, accidental or otherwise; but if the beginning of this disease is suspected, give at once linseed-oil, 1 pint; aloes, 2 drs.; Fleming's tincture of aconite, 8 drops.

Treatment.—In this disease there is considerable difficulty in giving remedies, owing to the contraction of the muscles of the jaws and the general stiffness. If the cause of the disease is some wound, it had better be poulticed, and dressed with carbolic oil or carbolic acid in 20 parts of water. Open the bowels by giving ½ dr. of powdered croton (or 20 drops croton-oil) in warm water, repeating the powdered croton in doses of 10 grs. (or croton-oil 10 drops) every eight hours till purging commences. If costiveness still continues, administer a clyster of olive-oil, 8 oz.; opium, ¼ oz.; warm gruel, 2 quarts.

Put the horse in a cool rather dark stable where there is plenty of air, keep him very quiet, and let no one but the attendant have anything to do with him. Mix an ounce each of extract of belladonna and bromide of potassium together, and place a piece of it about the size of a bean between the molar teeth every five hours by the aid of the forefinger.

Put a pail of gruel or sloppy mash in the manger, so that the animal can, if inclined, partake of it.

Never try to force food down the

animal's throat: it only aggravates the disease.

If the animal is a valuable one a veterinary surgeon should be called in, who will probably administer antitetanic serum, which is an almost unfailing preventive, and often seems useful in promoting a cure when the disease is taken in time.

Tetanus does not extend to the internal organs; the horse will suffer from hunger. When the horse is recovering, he should be fed moderately with nourishing food (bran-mashes, linseed, and oatmeal in preference), and he will be all the better for a turn or walk out of doors if the weather is suitable.

Megrims.

This disease is said to be caused by an undue pressure of blood in the head.

Symptoms.—The horse will suddenly stop, shake his head, then proceed on his journey at considerable speed. Sometimes he will turn round twice or more, often perspiring profusely, fall down, and either struggle on the ground or lie quietly. The attack may last five minutes, and when it is over the horse will resume work as though nothing had happened: he will, however, be considerably weakened. A horse subject to these attacks is particularly dangerous to ride or drive, and after one attack will always be liable to others in the future. Sometimes horses will die suddenly when seized with an attack.

Cause. — Violent exertion in hot weather; too small a collar or tight bearing-rein; a high system of feeding.

Prevention.—A proper-fitting collar and not too violent exercise; a judicious system of feeding, and an occasional dose of purgative medicine, such as No. 20.

Treatment.—Bleeding is of little use, though recommended by many authorities. Let the animal stand a few minutes, dash cold water on his head, push the collar forward, and proceed home as quietly as possible. Then give a physic ball (No. 17), and every six hours in water bromide potassium, ½ oz., for two or three days; afterwards give tonic (No. 21). Mashes and green meat should be given in preference to dry food, and a run out to grass for two months.

Palsy (Paralysis).

A deficiency in nervous power, which affects usually the hind quarters.

Symptoms.—Stiffness in their action, difficulty in turning, disinclination to lie down from the difficulty in rising again, and sometimes a total inability to rise.

Cause.—Pressure on the spinal cord from effusion of blood or serum, or from tumours within the spinal canal. Falls, injury to the spine from blows or from turning in too narrow a stable, old age, and heavy loads.

Prevention.—Humane treatment and ordinary care.

Treatment.—Give mild doses of purgative medicine, such as linseed-oil, 1 pint, which will not only open the bowels but also support the system. Rub stimulating embrocation, as mustard liniment (No. 15), on the part affected, and in cases of doubt, especially along the spine. Give morning and evening nux vomica tincture, 2 drs.; spirit of ammonia, 1 oz. in 10 oz. of water.

Stomach Staggers.

Disturbance of the brain resulting from a deranged and distended stomach.

Symptoms.—The first symptom may be dull, colicky pains, sleepy look, pulse very slow, profuse perspiration. In many cases blindness. Rests his head against the manger or wall, and sometimes moves his legs in a peculiar manner. Staggering gait till the horse falls down and dies in a state of stupor.

Cause.—Unsuitable food or over-feeding. Food in an overloaded stomach will swell and distend it, affecting the nervous system in such a way as to cause staggers.

Prevention. — Proper, regular, and systematic feeding with food of good quality will ensure immunity from this disease.

Treatment.—Give a purgative, such as 1 pint linseed-oil and 1 oz. of tincture of ginger. An hour after the dose of oil give in gruel draught (No. 9), and repeat the dose of oil if action of the bowels is not obtained. Clysters of warm water and soap should also be given every four hours.

Grass Staggers.

A disease manifesting nervous symptoms but arising from the stomach.

Symptoms.—They come on slowly; the horse is dull and listless at first, but gradually passes into a somnolent condition. In time the animal gets weak, reels or staggers about, and if sharply turned, will most likely fall down. It seldom lies down when suffering from this disease.

Cause.—It is mostly seen during the months of July and August, but varies according to the season. It arises from eating rye-grass at a certain stage of its growth, as if eaten in this state it causes the disease. In hot and dry seasons it is most frequent.

Treatment.—Remove the animal into a loose-box, give ball (17) and draught (9), and repeat the draught every four hours. Do not give any more rye-grass, but steamed oats, bran-mashes, and a little hay. Fresh, succulent, natural grasses may be given in very small quantities.

II.—THE EYE.

Cataract

is an opacity of the crystalline lens, and often follows an attack of ophthalmia.

Symptoms.—A speck in the eye, not on the surface, which varies in different eyes in colour, shape, position, and size. They often become large enough to cause blindness.

Cause.—From a blow, after an attack of ophthalmia, or inflammation of the eye.

Treatment.—In the lower animals very little can be done for it.

Amaurosis or Glass Eye.

Paralysis or loss of special sensation in the optic nerve.

Symptoms.—The eye looks larger, pupil dilated, animal stares—in fact, the eye is blind and motionless, and looks more like a glass eye than a natural one.

Cause.—It is seen as a temporary condition in some cases of poisoning, but when permanent it is the result of either partial or total loss of function in the optic nerve.

Treatment is of no use unless it is the effect of a poison; then give ball (17), a pint of linseed-oil, and every two hours give in pint of cold water 4 oz. of brandy and 2 oz. of spirits of ammonia aromat.

Inflammation of the Eye or Simple Ophthalmia.

Symptoms.—Eyelids swollen, watering, and nearly closed. Eye bloodshot, and inside of the eyelids very red. Cornea cloudy. Health not affected.

Cause.—Foreign matter, such as a hay-seed or chaff in the eye; a blow with a whip; or exposure in facing a cold wind. It is sometimes produced in a young horse by over-exercise.

Treatment.—First remove any foreign substance. Give mild purgative (No. 20) and a mash diet; bathe the eye with poppy-heads and warm water every two hours, and if that is not handy, with weak brandy-and-water; if no improvement, bathe with a solution composed of *liquor opii sedativus* 1 oz., in 1 pint of cold water. A useful lotion for inflammation of the eye is sulphate atropine, 4 grs., in 1 oz. of water. Keep the animal in a dark box until better. The inflammation should be cured in a few days; if not, treat as for Ophthalmia, *infra.*

Itching or Tumour of the Eyelids.

Treatment.—Rub the eyelids with mercurial ointment and lard in equal parts, and give sulphur, ½ oz., and nitre, 1 dr., in the food once a-day till the animal is cured.

Removal of the Eyeball.

It is necessary sometimes, when the eye has been severely damaged, or has a cancerous growth in it, to remove it. This can be done only by a veterinary surgeon, who will not only remove the eye, but, if you wish, place a glass one in its place. In using glass eyes always take them out at night, for if kept in very long they cause pain.

Ophthalmia.

Violent inflammation of the eyelids, extending to the cornea and internal structures of the eye.

Symptoms.—Light pains the eye,

which is kept shut; a profuse flow of tears. Pupil is contracted, and iris changes colour. The opacity usually extends from the circumference towards the centre, and the inflammation diminishes one day to increase twofold the next, till in a few weeks, if not checked, the eye becomes opaque and blindness comes on. After an apparent cure the disease will sometimes come on again, either in the same eye or in the other which had not previously been affected.

Cause.—A foul-smelling, ill-ventilated stable, reeking with ammonia and decomposing manure, is a frequent cause of this disease. Confinement in a dark stable and a sudden transition into the glaring sunshine often accounts for it. The tendency to inherit this disease from sires with defective sight is too well known from sad experience to need any comment. The management of horses being now better understood, this disease is becoming rarer every day.

Prevention. — A well-drained and well-lighted stable and cleanliness are the best preventives.

Treatment. — Foment the eye with warm water, and bathe with a lotion composed of sulphate of atropine, 4 grs., in 1 oz. of water. Feed on spare diet; put the horse in a cool, airy, but dark stable, where there is perfect cleanliness. Give purgative (No. 18 or 19). The use of the lancet may in extreme cases be useful; the inside of the eyelid should be exposed, and the lancet drawn lightly along for the purpose of relieving the parts affected by pressure of blood. Cloudiness of the eye, or complete opacity, is a frequent consequence of this disease, which may be treated by bathing with solution of corrosive sublimate, 1 gr., in 2 oz. of water.

Thickening of the Haw.

The haw of the eye is situated in the inner corner of the eye filling the lid. A horse can bring it forward over the eye, and with it wipe away any foreign matter that may have got into it. This haw sometimes enlarges and protrudes, so that it cannot retract.

Treatment.—Give purgative (No. 19), and bathe the eye with poppy-heads and warm water. Should the ulceration continue, bathe with white vitriol, ½ dr.; water, 6 oz.; or paint with a weak solution of silver nitrate. If further treatment is necessary, it must be left to a veterinary surgeon.

Warts on the Eyelids.

Treatment.—Cut off with a pair of scissors and touch with lunar caustic, taking care not to touch the eye, and not to put on more than is necessary. Rubbing the roots with blue vitriol will sometimes effect a cure. Take care also that any bleeding, when cutting, does not touch any other part, as blood from a wart may spread the disease.

Wounds in the Eye or Eyelids.

Generally caused by brutality or carelessness.

Treatment.—Very little can be done except to reduce the inflammation by purgative medicine (No. 20), and bathe with warm water, and apply a lotion composed of atropine, 4 grs., in 1 oz. of water. This lotion is best applied by the aid of a feather, which, when soaked in the lotion, should be drawn gently across the eye. When the eyelids are torn, never cut any of the skin off, but retain it in its proper position by the aid of pins or silver wire. In these cases the horse should be kept in a dark box.

III.—MOUTH, NOSE, TEETH, TONGUE, PALATE.

Glanders and Farcy.

These names have been long applied to what was believed to be two distinct diseases, but is now known to be only different manifestations of one and the same disease. Glanders has been recognised as affecting horses, asses, and mules from remote ages, and is now included under the Diseases of Animals Acts.

Cause. — Contagion. It is due to the *Bacillus mallei;* but overcrowding, insufficient food, want of fresh air, and insanitary conditions may predispose to it.

Symptoms.—Generally a discharge from one nostril, but may be from both; sometimes a cough, enlargement of the glands inside the lower jaw on the same side as the discharge. It is often

chronic, and the animal may work for months, taking its food fairly well, and little to cause suspicion but the nasal discharge. But sometimes there is a slight rise of temperature, and the animal seems sensitive to cold; the hair may get erect on coming out of a warm stable, or after a drink of cold water. One of the most characteristic appearances is the presence of ulcers inside the nostrils. These are very rare, apart from glanders. In the acute form there is high fever, the breathing is distressed, and the animal looks very ill. In the form known as Farcy, one or more of the limbs may become swollen, and the lymphatic vessels inflamed, hard, and cord-like; nodules, which may become as large as hazel-nuts, form here and there on the course of the vessels, generally burst, and discharge a yellowish oily matter. Although most common about the limbs, nodules often form about the head, neck, and other parts of the body. The discharge from the nose and from these nodules is the main source of the contagion, and is very dangerous to other animals, and also to man. It is not very rare for an attendant on a glandered horse to become attacked by the disease.

Glanders is scheduled under the Diseases of Animals Acts: intimation of its existence must at once be given to the police, and it is the duty of the Local Authority to cause every glandered animal to be slaughtered as speedily as practicable. They must also cause the detention of each horse, ass, or mule which, in their opinion, has been exposed to the risk of contagion, until such time as they can have the "mallein test" applied to it. Should the animal not react to the mallein test, the "detention notice" ceases to affect it after forty-eight hours. But when the animal reacts, it has to be slaughtered by the Local Authority.

For all such diseased animals so slaughtered the Local Authority must pay to the owner, as compensation, half the value of each animal before it was tested—the sum paid not to exceed £25 in the case of a horse, or £6 for any ass or mule. Where, after slaughter, the animal is found not to have been glandered, full value must be paid, but not over £50. And when an animal is slaughtered after being clinically affected — manifestly glandered, — the Local Authority shall pay whatever sum they think expedient, but not more than one-fourth the value of the animal, and not less than £2 in the case of a horse, and 10s. for any ass or mule.

Treatment is not permitted, although it is recognised that animals occasionally recover.

Prevention is comprised in careful isolation and disinfection, and the adoption of rigorous police measures.

Lampas.

A fulness of the lower bars of the palate.

Cause. — It generally occurs with young horses, and is a natural result from the congestion caused by the shedding of their milk-teeth and the growth of the permanent ones.

Treatment. — Cut the bars lightly with a penknife several times across, avoiding the artery. Never burn them. Give bicarbonate of potash, 6 drs., morning and evening in drinking-water, and warm bran-mashes. Use lotion (No. 16) for washing the sore places.

Nasal Gleet.

A profuse and unnatural discharge of mucus from one or both nostrils.

Symptoms.—The nasal discharge continues after every other sign of cold has left. Mucus in large quantities, mingled with matter, constantly flows or is blown from the nose, till the horse becomes much weakened. The mallein test may have to be applied to make sure it is not glanders.

Treatment. — Should cough remain, treat as for Cough (p. 447). If the discharge is fœtid, give daily a dose containing sulphate of copper, 1 dr.; ginger, 2 drs.; gentian, 2 drs. If the discharge is not offensive, but only an excessive discharge of the fluid which moistens the nose, give daily, sulphate of copper, 1 dr., made into a ball with flour and treacle. Horses affected by this complaint should always have a lump of rock-salt in their racks, and a little salt mixed with the most nourishing food possible. Tonic (No. 21) may be useful in treating this disease. Nasal gleet of

long standing may be due to a diseased tooth or bone in the head, and the opinion of a veterinary surgeon should be obtained.

Polypus.

An excrescence may grow in the nostril or further back and impede the breathing. It must be removed by a veterinary surgeon, and no treatment by an unprofessional man can be of any use.

Bleeding from Nose.

The result of irritation of the nose, glanders, bursting of a blood-vessel in the head or lungs, and sometimes a blow on the head.

Treatment.—Keep animal quiet, head elevated, and pour cold water over it. Give every two hours, in a pint of gruel, tincture of perchloride of iron, 1 oz.; spirits of sweet nitre, 2 oz.

Rabies or Hydrophobia.

See Dogs (p. 493).

Strangles.

A disease more common among colts and horses under four years old than among older ones.

Symptoms.—A cold, cough, sore throat, and profuse discharge of yellow mucus from the nostrils, swelling under the throat, which increases and renders swallowing painful. The tumour is situated in the centre of the throat under the jaw, and feels like one solid mass. Owing to its solidity this disease can readily be distinguished from Glanders (see p. 443) when the tumour is composed of separate parts, which can be easily identified. The centre of the tumour is soft, and when it suppurates and bursts it discharges an immense quantity of pus, quickly healing after the discharge. When the cough subsides, the horse begins to recover from the extreme weakness attending the disease.

Cause.—Probably cold or climatic changes. I have strong reasons for believing that this disease is contagious.

Prevention.—Isolate affected animals.

Treatment.—Blister the tumour with ordinary blister (No. 1 or 2) to hasten its progress and prevent the inflammation spreading. When the tumour is soft on the top, lance it and suffer the pus to drain out without any pressure. After the discharge, keep the place clean by bathing it well with warm water; rub with vaseline, which will soften the wound and promote its healing. Give twice daily, in a pint of gruel, No. 9, and keep the bowels open with carrots and bran-mashes. Feed on bran-mashes and green food, and keep the animal in a cool and comfortable stable. When recovery is established, give morning and night tonic (No. 21), and keep the horse well. The discharge from the nose will continue some time, but will gradually cease. If this disease is neglected, death will probably follow.

Bastard Strangles.

A low form of strangles, in which abscesses appear on different parts of the body. The treatment should be the same as for ordinary strangles. In this disease there is much more danger of blood-poisoning.

Teeth (Diseases of).

The irregular growth and rough edges of the teeth frequently produce wounds in the mouth. A horse out of condition should be examined, and if his teeth are irregular or have rough edges, they should be rasped down with a file that is made for the purpose. Sometimes it is necessary to cut off part of a tooth which projects far above the level of the others.

Extracting Teeth.

To extract the corner teeth of a three- or four-year-old horse, so as to try and alter his age, is cruel, and any one with experience of horses can easily see on looking into the animal's mouth if such a thing has been done.

Wolf-teeth.—These little teeth are situated in front of the molars, and are believed by some to interfere with the animal's feeding. They can be easily extracted by the aid of a pair of forceps, or else punched out. But unless it is distinctly evident that they are causing trouble they should be left alone.

Molar Teeth.—They sometimes be-

come diseased. The animal quids his food, and frequently when feeding pauses for a few seconds. The breath is very offensive. Their treatment should certainly be left to the veterinary surgeon.

Wounds in the Mouth.

From a cruel bit, &c.

Treatment.—Wash it with a solution of alum, 1 oz., dissolved in twenty-eight times its weight of water; or use lotion (No. 16).

Teething Cough.

A persistent and violent cough.

Symptoms. — Usually seen between the age of three and four. Food refused, head poked out, gums red and swollen, frequent coughing, and sometimes a tooth is found in the manger.

Cause.—Teething, which causes irritation of throat.

Treatment.—Extract any temporary teeth showing signs of getting loose, and blister throat with mustard liniment (No. 15), and give every night and morning, in a pint of gruel, draught (No. 10).

Wounds of Tongue.

Treat as for wounds of the mouth.

Tongue Bladders (Ranula).

Sometimes occur underneath the tongue.

Cause. — Produced by a slight derangement of the system.

Treatment.—Give a physic ball (Nos. 17 or 18), which will reduce any fever. The bladders may be readily removed by opening with a lancet.

Paralysis of the Tongue.

Palsy of the tongue.

Symptoms.—The tongue hangs in a loose manner from the mouth, and becomes swollen and inflamed.

Cause.—A severe injury to tongue, or by dragging on the tongue when giving a ball.

Treatment.—Suspend the tongue in a net-bag tied to the head-stall; give purgative (No. 19) and a drachm of nux vomica night and morning in a half-pint of water.

Amputation of Tongue.

This is sometimes done by veterinary surgeons when the tongue has been extensively lacerated. A horse that has lost part of his tongue must be fed from a deep manger, and in drinking these animals force their heads deeply into a pail of water.

Paralysis of the Lower Lip.

A pendulous condition of the lower lip.

Symptoms.—The animal's health is not interfered with, and he feeds fairly well, but lets a little food drop, his lip hangs down, and a little saliva flows from it.

Cause.—Paralysis of the nerve of the lip, which is usually brought about by the curb-chain being too tight, or a badly fitted bridle, or accidental injuries.

Treatment.—Give a physic ball, containing 5 drs. of aloes, and rub into the lip and sides of the face a little of embrocation (No. 12). Feed on sloppy mashes.

DISEASES AFFECTING THE THROAT, CHEST, RESPIRATORY ORGANS, AND BLOOD.

Bronchitis,

or inflammation of the bronchial tubes.

Symptoms. — Coughing, wheezing, hard breathing, and weakness. The horse may die in a severe attack from suffocation.

Cause.—In cases of neglected cold or catarrh, bronchitis often follows. Exposure to cold or wet. Common in young animals that are starved and neglected.

Treatment.—Give plenty of fresh air, but keep warm. Apply embrocation (No. 12) to the chest; give nitre, 3 drs., and Fleming's tincture of aconite, 10 drops, three times a-day, and increase the dose if necessary. Feed on bran-mashes containing linseed-meal. For drinking-water, give weak infusion of linseed. In acute cases, give in gruel draught No. 10 three times a-day.

Broken Wind.

Symptoms.—In this disease the expiration of the breath takes two efforts, and the inspiration only one; the breathing, therefore, is not regular, as in thick wind.

Cause.—It is due to the rupture of air-cells, and is generally attended by a dry cough. Dusty food, gross feeding, previous inflammation, and violent exercise after heavy feeding.

Treatment.—There is no *cure*. Keep for slow work, and feed on soft nourishing food which occupies a small space.

Crib-biting

is more a vicious habit than a disease.

Symptoms.—The animal seizes the manger or any fixed object, and makes a gulping noise as if trying to swallow air.

Cause. — Indigestion or habit; one horse will learn it from another.

Treatment.—It takes a lot of curing. Anchovy paste on the manger will sometimes effect a cure. Any saddler will make a strap to go round the horse's neck to prevent crib-biting. An invention has been recently brought out to cure it by the aid of electricity. The battery is placed in such a way that whenever the animal seizes and squeezes the top part of the manger he at once receives a severe shock.

Choking.

Substances which have lodged in the gullet can generally be forced down by the use of a flexible tube, similar to that used for cattle; but it should only be done by a veterinary surgeon.

Sore Throat.

A common complaint, and associated with such diseases as strangles, influenza, and scarlet fever, &c.

Symptoms. — Animal has a nasty cough, quids his food, and pokes out his nose.

Treatment.—Blister the throat with embrocation (No. 12), feed on sloppy food, and give in gruel twice a-day (No. 10). Be careful in drenching, as there is a risk of choking the animal.

Rheumatic Fever.

A specific fever due to a constitutional condition of the system.

Symptoms.—Animal restless, breathing hurried, slight cough, shows signs of pain, goes stiff, and joints swell.

Cause. — Hereditary tendency, bad stables, and insufficient food.

Treatment.—Give physic ball (No. 20), put half an ounce of nitre frequently in drinking-water, and give twice a-day the following ball: iodide of potassium, 1 dr.; powdered colchicum, 20 grs.; liquorice-powder, 2 drs., made up with linseed-meal and treacle. Rub the swollen joints every night with embrocation (No. 12), and apply woollen bandages.

Chronic Cough.

A most annoying disease to the rider. This cough frequently follows an attack of inflammation of the lungs.

Symptoms.—If the horse coughs after drinking, the cough will arise from the windpipe. It may not affect the general health.

Cause. — Previous inflammation, neglected cold, and sometimes worms.

Treatment. — If the coat is staring, the cause of the cough will generally be worms, in which case give turpentine, ½ oz., daily, in 4 oz. of linseed-oil; or santonine, 20 grs., and aloes, 3 drs., made into a ball with linseed-meal and treacle, in the morning on an empty stomach, and repeat after two days; or give draught (No. 11). If the cough proceeds from the throat, feed on green food and mashes, and give ball (No. 8). Apply blister (No. 2) to the throat if other remedies fail. Water, in which a little linseed or treacle has been boiled, is useful instead of plain water, for drinking purposes.

Common Cold.

Symptoms. — Slight discharge from the nose, and weeping of the eyes; fever and cough.

Cause.—Changes of temperature and chills.

Treatment. — Clothe warmly, and place in a cool stable. Feed on warm bran-mashes with a little linseed-meal in them, and give in gruel night and morning till fever is reduced—acetate

of ammonium, 3 oz.; potassium bicarbonate, ½ oz.; chloroform, ½ oz.; and apply liniment (No. 14) to the throat, or embrocation (No. 12).

Distemper, Catarrhal Fever, or Influenza.

Most prevalent in spring and autumn, especially when the weather is cold and wet.

Symptoms.—At first dulness, loss of appetite, and there may be shivering, cough, weakness, inflamed eyes, nose a pale red, watery discharge from nostrils. Later the discharge from the nostrils becomes thick, but seldom offensive, glands of throat and under jaw swell, which make swallowing difficult. Generally there is intense weakness.

There is a violent form of influenza which has lately come into notice called "pink eye." It is attended with high fever, extreme weakness, depression, and loss of appetite, and has been the cause of serious loss in many parts of the country.

Cause.—Contagion, influences of climate producing cold, amounting almost to an epizootic.

Treatment.—Remove into a cool box, clothe warmly, feed on warm bran-mashes and green food, a little hay, or a carrot or two, and give in weak infusion of linseed 1 oz. nitre, instead of pure water for drinking. Sponge the nostrils with vinegar and water. Give draught twice a-day containing spirits of nitrous ether, 1 oz., *liquor ammonii acetatis*, 3 oz., in a pint of water, and rub the throat with embrocation (No. 12). Half fill a nose-bag with hay, and pour boiling water upon it, and keep the horse's head in it till the vapour ceases to rise, but be careful not to burn the horse's nose. In cases of extreme depression, as in pink eye, give every three hours spirits of nitrous ether, 1 oz.; whisky, 4 oz.; water, 6 oz. When recovering, give tonic (No. 21) in a pint of beer twice a-day. Great care should be taken to prevent these attacks producing roaring and other diseases.

Broken Ribs.

The ribs of horses are frequently broken through accidents and kicks.

Treatment.—If the ribs are only broken and not the skin, put a good pitch-plaster over that side of the chest; but if the skin is broken and there is a hole in the chest, it is beyond the power of any one but a veterinary surgeon to effect a cure.

Dropsy of the Chest.

The result usually of pleurisy.

Symptoms can be detected only by placing the ear against the chest, and by percussing the chest wall.

Treatment.—Call in a veterinary surgeon, who may tap the chest and let the fluid out.

There is a disease amongst colts running on low marshy land of a dropsical nature, but in this disease the swelling is seen on the outside of the chest and along the abdomen.

Treatment.—Take colt in from the grass, give good food, and every night and morning, in a pint of gruel, give tonic (No. 21).

Simple Fever.

Symptoms.—Staring coat, cold legs and feet, dulness, alternate shivering and hot fits, constipation. There is no cough or turning round to the flanks.

Cause.—Sudden change from heat to cold, often produced by the improper ventilation of a stable; checked perspiration.

Treatment.—Place in a cool stable where there is good air without draught, warm clothing, and give soft food while the fever is at its height, and then a more generous diet. Give mild opening medicine, such as linseed-oil, ½ pint. On no account give active purgatives. Clysters of warm water and soap will aid the action of the bowels, and give every four hours a draught containing solution acetate of ammonium, 3 oz.; Fleming's tincture of aconite, 5 drops; spirits of nitrous ether, 1½ oz., in pint of water. The disease is not dangerous, unless complications ensue.

Bleeding

is gradually becoming a thing of the past, but it is sometimes beneficial, especially where there is great blood-pressure, such as brain-fever, mad staggers, and acute founder.

How to Bleed an Animal.—Put a

driving bridle on the horse, bring his head round to the light, turn it to the left side, raise the jugular vein on the right side by pressing on it with the fingers, hold the fleam in the left hand parallel with the vein, and give it a smart blow with the blood-stick; keep the bucket pressed against the neck below the wound, and if the blood does not flow freely, insert the fingers into the mouth to keep the jaw moving. Take from 1 to 3 quarts of blood, afterwards place a pin through the lips of the wound, and wind tow around it. Do not use too large a fleam.

Inflammation of the Jugular Vein after Bleeding.

The wound caused by bleeding is generally held together by a pin and piece of twisted tow; it will usually heal in a couple of days. If the fleam has been carelessly used, or has been dirty, the wound is apt to become inflamed, swell, and discharge matter. Abscesses will then form, and if not checked will prove dangerous.

Treatment.—Wash the wound at once with a solution of carbolic acid, 1 part in about 20 parts of water; but it is a dangerous condition, and as soon as inflammation of the vein is suspected a veterinary surgeon should be called in.

Purpura or Purpura-hæmorrhagica.

A blood disease of a very low type.

Symptoms.—Is seen frequently after severe illnesses, as strangles and influenza. The legs, nose, and lips swell, pink spots are seen inside nose and eyelids; animal refuses food, and looks a pitiful object.

Cause.—Sequel to other diseases, or from bad hygienic conditions.

Prevention.—See that your stable-ventilation, drainage, and food are good.

Treatment.—Is best left to a veterinary surgeon.

Inflammation of the Lungs or Pneumonia.

Symptoms.—Fever and quickening pulse, cold ears and legs, breathing thick, nostrils dilated, restlessness, unwillingness to lie down, and staring coat. Sometimes the attack comes on suddenly and sometimes gradually.

Cause.—Cold, over-driving when out of condition, and contagion.

Treatment.—Remove to a cool airy loose-box, and clothe warmly; rub the legs well, using white oil liniment (No. 14); feed on green food and bran-mashes only; apply embrocation (No. 12) to each side of the chest; give every four hours a draught containing acetate of ammonium, 3 oz.; bicarbonate potash, ½ oz.; Fleming's tincture of aconite, 3 drops; water, 8 oz., till the fever is subdued. When convalescent, give tonic (No. 21), and two months' run at grass if the season permit.

This is a very dangerous disease, and the aid of a veterinary surgeon should be obtained.

While suffering from fever the diet should be sparing, and entirely composed of green food, carrots, and cold bran-mashes. The open air is preferable to a close warm stable: it is of the first importance that the horse should have cool fresh air to breathe. If this disease is neglected, the after-consequences, even should the horse recover, will be most serious, and his constitution will be ruined.

Scarlet Fever.

A feverish disease of the horse, characterised by pink spots in the nose and mouth, and usually associated with a sore throat.

Symptoms.—The animal dull and off its feed, eyes swollen, pink spots inside the nose and eyelids, and frequently a sore throat.

Treatment.—Place the animal into a comfortable loose-box, give thrice a-day, in gruel, draught (No. 9), and when recovering, give tonic (No. 21) in a pint of ale twice a-day. This disease is now generally considered as a mild type of purpura-hæmorrhagica.

Pleurisy.

A disease affecting the membrane covering the lungs and lining the chest.

Symptoms.—Very similar to those of inflammation of the lungs, except that the pulse is hard and small, the breathing shorter and painful, and performed mostly by the abdominal muscles, showing a line at each expiration from the lower border of the ribs to the flank.

Cause.—Chills.

Treatment.—Remove into a cool airy stable, and feed on cold bran-mashes and green food. Rub the chest and sides with embrocation (No. 12), and give twice a-day oil of turpentine, 1 oz.; iodide of potassium, 2 drs.; linseed-oil, 4 oz.; lime-water, 6 oz. Call in a veterinary surgeon, who may resort to the use of the trocar to tap the chest. Complete rest at grass, if possible, and tonic (No. 21) should follow when the animal is recovering.

Heart Disease,

as a rule, causes interference with blood circulation.

Symptoms.—There is really but one true symptom, and that is the irregularity of the pulse, but often associated with this there is weakness, cough, hurried breathing, and sometimes the animal staggers as if in want of breath.

Cause. — Rheumatic usually in its origin.

Treatment.—Rest, but often there is no improvement.

There are several inflammatory diseases of the heart, but it would only be wasting time to enumerate them here, for they are of a complicated nature and not common.

Poll Evil.

A painful swelling on the upper part of the neck behind the ears, generally terminating in an abscess.

Symptoms.—Inflammation and swelling of the ligaments over the atlas bone.

Cause.—Tight reining, blows on the neck and head from striking the manger, or lintel of the door, or given by a savage attendant.

Treatment. — Apply cooling lotion, such as goulard water, to the swelling, and keep the bowls open with purgative (No. 18). If the tumour increases, apply common blister (No. 3) to hasten its discharge, and when it is soft in the middle it should have a seton drawn through the tumour from the top, through the bottom, out at the side below the tumour; this will completely drain the abscess. Then foment and clean with warm water till cured. The aid of a veterinary surgeon should be obtained to ensure the successful treatment of the tumour.

Roaring.

A rough, disagreeable noise made by some animals during respiration, especially if forced to exert themselves.

Symptoms.—A roaring sound when sharp exercise is taken, caused by the difficulty of the air passing through the contracted opening of the larynx.

Cause.—Frequently results from an attack of strangles. Tight reining tends to produce it.

Treatment.—There is no cure in the case of a confirmed roarer. In early stages rub blister (No. 1) on the throat, and give a ball morning and night, composed of nux vomica, ½ dr.; arseniate of iron, 3 grs.; quinetum, 1 dr. Nothing further can be done.

Saddle Galls.

Cause.—A badly fitting saddle, or heavy bad rider.

Treatment. — Apply lotion (No. 7), alter the saddle, and do not work until cured.

Sore Shoulders.

The shoulders of horses sometimes become very sore and painful, and when in this condition, if neglected, large wounds and abscesses soon follow.

Cause. — Badly fitting collar, heavy loads, the draught badly adjusted, using one trace longer than the other, and working horses too young.

Treatment. — Bathe the shoulders night and morning for an hour with warm water, then apply lotion (No. 16) to the parts where the skin is broken. Do not work the animals until they are properly healed, for you can be summoned for working a horse with sore shoulders.

Sitfasts.

These are small hard tumours which form in the substance of the skin where the harness comes in contact with it.

Cause.—Pressure of the saddle. Small pimples or pustules from an unhealthy condition of the skin, and are often due to necrosis—death—of a small patch of skin.

Treatment.—Give rest, foment, and apply cooling lotion. Should they suppurate, wash with tincture of myrrh,

1 oz.; carbolic acid, ½ oz.; glycerine, 2 oz.; and water, 10 oz. If they make no progress towards healing, apply a little blister (No. 1) to the ulcers, and dress the wounds with friars' balsam. But it is often advisable, and brings about a far more speedy recovery, to have the hard core in the centre carefully removed with the knife. Alter the saddle and make it fit.

Stricture of Gullet.

Symptoms.—A contraction of the gullet which prevents the passage of food.

Can be cured only by a veterinary surgeon.

Thick Wind.

Symptoms.—Difficulty of breathing when driven. Short hurried respirations. This complaint is most usual in horses with contracted chests, often resulting from an attack of inflammation of the lungs.

Treatment.—This annoying disease can be mitigated only by careful management, avoiding sharp exercise after feeding, and by never giving a very full meal. The food should be of a very nutritious nature in small bulk. A thick-winded horse may be able to go a good pace without inconvenience, if he is not hurried when he first leaves the stable.

Whistling and Wheezing

are forms of broken wind, which can be mitigated only by using the animal for slow work. A drink made of linseed-meal, one pint, boiled in six pints of water, with a little treacle, may do good, but there is no cure.

Withers (Fistulous).

Symptoms.—This troublesome disease first appears as a swelling on the withers, develops into a tumour, suppuration takes place, and a deep ulcer forms, which may extend down to the bone.

Cause.—Pressure on the withers from an ill-fitting saddle or collar.

Treatment.—Give the horse complete rest till cured; do not work him till then under any pretence. Upon the first appearance of the swelling, foment, and apply lotion (No. 7). If the tumour appears, apply blister (No. 1 or 3). The veterinary surgeon should be called in if this does not stop the inflammation. Keep the bowels open by feeding on green food and bran-mashes.

DISEASES AFFECTING THE STOMACH, LIVER, BOWELS, KIDNEYS, AND OTHER INTERNAL ORGANS, AND PARTURITION.

Bots.

The larvæ of the gad-fly. Most common in spring and early summer. The eggs of the gad-fly are deposited among the hair, and are introduced into the stomach through the horse licking himself. They attach themselves to the lining of the stomach during the winter, injuring and weakening it, till finally they are seen escaping in the spring out of the anus, causing great itching.

Treatment.—No medicine will totally destroy these bots. The use of salt among the food may serve to mitigate the evil, and a draught containing oil of turpentine, 1 oz., linseed-oil, 10 oz., may remove many of them, but very little can be done, and nature must be left to take its course. Green food assists in bringing them away.

Colic or Gripes.

1. *Flatulent Colic.*

Symptoms.—Stomach and intestines distended with gas; pain and depression.

Cause.—Overloading of the stomach with green food; cold and over-exertion.

Treatment.—Give a purgative (No. 17), and clyster (No. 13), and every two hours give a draught containing opium tincture, 1 oz.; spirit of ammonia, 1 oz.; carbolic acid, 15 drops; chloroform, 1 oz., in 12 oz. of water.

2. *Spasmodic Colic.*

Symptoms.—Acute pain, rolling on the ground, suddenness of attack, excited countenance, and the intermittent nature of the pain. This last characteristic distinguishes the disease from inflammation of the bowels.

Cause.—Chills from drinking cold water when hot, and errors in feeding

and watering, are the most common causes.

Treatment.—If taken in time, this disease can usually be cured by giving linseed-oil, 1 pint; oil of turpentine, 1 oz.; tincture of opium, 1 oz.; chloroform, 1 oz. Walk the horse about after giving the dose. If the attack continues, apply hot fomentations to the belly till the aid of the veterinary surgeon can be obtained.

Diarrhœa.

Frequent passing of fluid dung.

Symptoms.—Animal dull, refuses food, slight colicky pains, and frequent dunging, which, if not checked, will terminate in inflammation of the mucous membrane of the bowels.

Cause.—Bad feeding, or feeding on raw potatoes, too succulent green food, cold and irritation of the bowels from worms or innutritious food.

Treatment.—Place animal in a warm box, if cold put a rug on and bandage his legs, keep short of water, and give in half-pint of gruel twice a-day the following: Tincture of catechu, 1 oz.; powdered chalk, ½ oz.; tincture of cardamoms, 1 oz.; opium powder, 1½ dr. To be continued until the diarrhœa ceases.

Constipation.

Generally arising from the nature of the food or torpidity of the liver or intestines.

Prevention.—All dust from chop or chaff should be sifted out of horse's food, and too much mealy or dry food should not be given without access to water.

Treatment.—Give purgative medicine—linseed-oil, 1 pint, and plenty of watery food, gruel, &c., and warm clysters of soap-and-water, repeating the dose of oil when required. For chronic constipation give daily a ball composed of aloes, 1 dr.; nux vomica, ½ dr.; carbonate ammonium, 1 dr.; ginger, 1 dr.; gentian, 1 dr.

Dysentery.

A continual passing of semi-solid dung, tinged with blood.

Symptoms.—It first starts with diarrhœa, which passes into dysentery; the animal becomes restless, occasionally lies down; in the course of a few hours it trembles; clots of blood are passed with the dung, which has a bad smell if not soon checked; a cold sweat breaks out, the legs become cold, the eye glassy, and death closes the scene.

Cause.—Too large a dose of physic, worms and improper feeding, associated with a bad sanitary condition of the stable.

Treatment.—Put animal in a warm box; if cold put a rug and bandages on. Give every six hours until the purging ceases the following drench in half a pint of gruel: Chlorodyne, ¼ oz.; powdered opium, 1 dr.; prepared chalk, ½ oz.; tincture of cardamoms, 1 oz.; old port wine, ½ pint.

Diabetes or Polyuria.

Symptoms.—Excessive discharge of urine, weakness, and unthrifty appearance.

Cause.—Irritation of the kidneys by a too frequent use of diuretics or bad, musty, or mouldy food.

Treatment.—Feed on green food and mashes, and give morning and night in gruel a draught containing dilute hydrochloric acid, 2 drs.; quinetum, 1 dr.; tincture of opium, ½ oz. The part of the loins over the bladder should be covered with a hot cloth. Attend to the quality of the food, and in severe cases call in a veterinary surgeon.

Inflammation of the Bowels.

Very fatal, often resulting in death in a few hours.

Symptoms.—At first uneasiness and dulness; fever, and in some cases shivering fits; nostrils red and mouth hot; breathing and pulse quick; ears and legs cold; and the passing of small quantities of dung at short intervals. The horse will show great pain by kicking at his belly and whisking his tail.

Cause.—A chill when overheated, often from drinking cold water when hot, over-exertion, a too full meal when the animal is tired and worn out.

Prevention.—These inflammatory diseases of the internal organs are too common among draught-horses. There is no more pernicious habit than that of working horses during hot weather, without allowing them for hours together to

have any drinking-water till they get into a probably cold stable, where they are allowed to drink their fill and stand for an hour during the dinner-hour till they are chilled inside and out. It seems extraordinary that so many horses stand this treatment. Allow farm-horses frequent moderate drinks of water while at their work, when that work is heating or the weather hot. The exercise after drinking will prevent any chills, and on their return to the stable they will eat their corn without requiring water to an injurious extent. The custom of giving horses large quantities of coarse boiled food was often to blame for causing this disease.

Treatment.—Place in a cool stable and clothe warmly; give warm clysters of thin gruel and Epsom salts, ½ lb. Foment the belly with hot water and rub it with embrocation (No. 12), and every three hours give in gruel tincture of ginger, 1 oz.; tincture of opium, 1 oz.; chloroform, 4 drs. Rub and bandage the legs. Give plenty of warm linseed-gruel. If costiveness continue, give with great caution in gruel small doses of aloes, 2 drs. dissolved, and ½ pint linseed-oil, and send for a veterinary surgeon.

Gastritis or Inflammation of Stomach.

A disease of rare occurrence.

Symptoms.—Animal shows signs of pain, breathes hard, sweats about the shoulders, thirst, flow of saliva, great prostration, legs and ears become cold, the animal staggers, and soon dies.

Cause.—Too much food rapidly swallowed, foreign body in stomach, or from a vegetable or mineral poison.

Treatment.—Give linseed-oil, 1 pint; tincture of opium, 2 oz., and give after every two hours two eggs beaten up in a pint of linseed-gruel, and add to it an ounce of tincture of nux vomica, and one of tincture of belladonna.

Twist of the Bowels.

A twist in a portion of the bowels, which may cause strangulation, mortification, and death.

Symptoms.—Excruciating pain, the animal is up and down, blowing heavy and sweating, nothing seems to give ease, and death comes as a happy release.

Cause.—Mostly rolling when in pain.

Treatment.—Nothing can do any good except opium, which will ease pain until death.

Inflammation of the Bladder.

See Inflammation of the Kidneys for symptoms and treatment, *infra.*

Cause.—Irritant matter in urine, or stone in the bladder.

Inflammation of the Neck of the Bladder.

Symptoms.—Distended bladder and partial to total suppression of urine.

Cause.—Overstraining or cold.

Treatment.—Give purgative (No. 17), and three times daily in gruel a draught containing Fleming's tincture of aconite, 5 drops; tincture of opium, 1½ oz.; bicarbonate of potash, ½ oz. Apply hot fomentations to the loins, and call in a veterinary surgeon, who will, if necessary, draw off the urine with a catheter.

Parturition.

The act on the part of a mare to bring forth her young. The period of pregnancy in the mare is usually eleven months, though it sometimes varies between ten and twelve months. This animal seldom brings forth more than one at a time, nevertheless twins sometimes do occur, but they rarely live long after birth.

Signs of Foaling.—The mare is dull, abdomen sprung, back bent, vulva swollen, and a little mucus discharged. The udder becomes enlarged, wax appears at the ends of teats. As the time draws near the mare becomes restless, paws, keeps on lying down, an anxious expression in the eyes, and frequent passing of dung and urine. The water-bag soon makes its appearance, which ultimately bursts, after which the foal appears.

Treatment.—The mare should be placed in a nice clean loose-box with plenty of straw, and do not disturb her by keeping open the door and looking in frequently.

Inflammation of the Kidneys.

Symptoms.—Fever and peculiar position, standing with legs wide apart; hot loins, and tenderness in that part; sup-

pressed urine, which is dark in colour and may be tinged with blood; straining to void urine. Put the hand up the rectum, and the bladder under the rectum will be empty without undue heat. In cases of inflammation of the neck of the bladder, it will feel hard and full. In cases of inflammation of the bladder, it will feel empty, but there will be great heat.

Cause.—Unwholesome food, particularly musty oats, or a violent overstraining or cold.

Treatment.—Remove into a comfortable box, clothe warmly, give plenty of water, feed on linseed and bran-mashes, foment the loins with hot water. Apply embrocation (No. 12) to the loins over the kidneys, but leave the turpentine out of the embrocation, and give purgative (No. 17); give also warm clysters of soap-and-water. When the purgative has acted give white hellebore, 5 grs.; tartar emetic, 1 dr., mixed into a ball, three times a-day till cured. If possible, find out and remove the cause of the disease, if it arises from improper food.

Inflammation of the Womb.

An inflammatory disease of the womb shortly after foaling.

Symptoms.—Animal becomes dull and stiff, appetite lost, secretion of milk diminished, breathing hurried; the animal grinds her teeth, suffers from colicky pains, frequently lies down, stamps, kicks at her belly, the vulva is swollen and a discharge comes from it, which is at first yellow, but afterwards becomes a chocolate colour, and fœtid.

Cause.—Exposure to cold, retention of the after-birth, and injuries received during foaling.

Treatment.—Put hot cloths across the loins, and give every three hours the following draught in a pint of linseed-gruel: tincture of belladona, 1 oz.; spirits, ether (nitrous), 2 oz.; and soda sulphite, ½ oz.

Inflammation of the Liver.

An uncommon disease.

Symptoms.—Dull pain, but no great uneasiness, yellowness of the mouth and nostrils.

Cause.—Overfeeding and insufficient exercise.

Treatment.—Should the attack be severe, call in a veterinary surgeon. Give for a purgative—sulphate of soda, 5 oz.; virgin scammony, 30 grs.; and feed on bran-mashes with a light diet. A useful draught, to be given three times a-day in gruel, is composed of chloride ammonium, 2 drs.; bicarbonate potassium, ½ oz.; Fleming's tincture of aconite, 5 drops; chloroform, ½ oz.

Jaundice or Yellows.

Symptoms.—A yellow tinge in the eyes, skin, and mouth; urine quite yellow; loss of appetite, and constipation.

Cause.—Obstruction of the flow of bile from the liver, disease of the liver or congestion arising from cold or other cause.

Treatment.—Feed on mashes, thin warm gruel, and green food; clothe well if weather is cold; give every morning calomel, ½ dr. If inflammation sets in, give every morning in gruel a draught containing solution acetate ammonium, 4 oz.; Fleming's tincture of aconite, 5 drops; spirits of nitrous ether, 1½ oz. When recovering give tonic (No. 21).

Peritonitis.

Inflammation of the lining membrane of the abdomen.

Symptoms.—Small hard pulse, colicky pains, dulness, constipation, and tenderness on pressure over the abdomen, which feels hard and rounded.

Cause.—It may arise from cold and neglect, but generally from worms or wounds, as after castration.

Treatment—Hot fomentations persistently applied; give opium or laudanum, with small doses of spirits of ammonia every four or five hours, gruel and linseed-tea to drink, and soft sloppy food.

Poisons.

The only vegetable poison that need be mentioned is yew. The eating of this tree accounts for the death of many horses every year. If the poison is suspected, give at once linseed-oil, 20 oz., and drench with spirits of ammonia, 3 oz.; brandy, 5 oz.; gruel, 1 pint. Repeat dose of oil if it does not operate in twelve hours.

Lead-poisoning.

A disease due to the introduction of lead into the system. Although comparatively common in cattle is rare in the horse.

Symptoms.—The horse has a careworn expression, staring coat, back arched, legs cramped, colicky pains, and flow of saliva from the mouth.

Cause.—Grazing near rifle-butts or lead-smelting works, drinking water impregnated with lead, licking lead paints, and the barbarous practice of giving shot for broken wind.

Treatment.—Give sulphate of magnesia, 8 oz., in a pint of water, with tincture of belladonna, 1 oz.; tincture of capsicum, ½ oz. Afterwards, give every four hours until the animal is purged, sulphate of magnesia, 1 oz., tincture of belladonna, 1 oz., in half a pint of water.

Arsenic-poisoning.

Due to arsenic either given accidentally or intentionally.

Symptoms.—Colic, staggering gait, quick breathing, cold ears, diarrhœa, and death.

Cause.—It is sometimes caused by grooms giving it to improve the condition of their horses, or by allowing animals to graze where recently dipped sheep have been lying.

Treatment.—Give every two hours the following in half a pint of water: iron sesquioxide, ½ oz.; brandy, ½ pint.

Umbilical Hernia.

A round swelling under the belly of young horses.

Symptoms.—A soft swelling in the centre of the abdomen, ranging in size from a fowl's egg to a cocoa-nut.

Cause.—Due to non-closure of the navel.

Treatment.—Trusses, bandages, or plasters frequently fail, and it may have to be operated on by a veterinary surgeon.

Scrotal Hernia.

Descent of the small intestines into the scrotum.

Cause.—By galloping, or a severe strain, but very often there at birth.

Symptoms.—The scrotum looks large and feels soft, but is not always the same size.

Treatment.—Castrate by the covered operation (p. 497).

Staling of Blood,

or mixture of blood with the urine.

Cause.—Inflammation or injuries of the kidneys.

Treatment.—Feed on green food and mashes; clothe warmly; give Fleming's tincture of aconite, 8 drops, every night. Purgative (No. 17) should be given, and three times a-day a draught in gruel, composed of extracts of ergot, ½ oz.; tannin, ¼ oz.; dilute sulphuric acid, 2 drs. When the appearance of blood in the urine has ceased, give daily Peruvian bark, 1 oz.; sulphate of iron, 1 dr.

Stone in the Bladder (Calculus).

Symptoms.—Irregular voidance of urine, sometimes total suppression, great pain, suddenness of attack, great uneasiness, a sediment from the urine on the floor of the stable, and profuse perspiration during attack.

Cause.—Formation of solids in the bladder, often brought on by weakness or disease of the kidneys.

Treatment.—Give morning and evening, in gruel, a draught containing bicarbonate of potassium, 1 oz.; benzoate ammonium, 1 oz. If the gravel or small stones are not passed, place the case in the hands of a veterinary surgeon, who will treat it for calculus, the removal of which requires an operation, the stone being too large for the horse to pass.

Worms.

Symptoms.—Rough coat and half-starved appearance, at other times an enormous appetite, but no improvement in condition; appearance of a yellow powder about the anus, with irritation and switching of the tail.

Treatment.—When fasting give in gruel draught (No. 11), and repeat in three days.

Prolapse of the Rectum.

Cause.—A drastic purge, injuries, straining during foaling or in a violent fit of colic.

Treatment.—Wash the gut with equal

parts of olive-oil and *liquor opii sedativus*, and gently work it back to its proper place; afterwards depress the tail.

DISEASES AFFECTING THE LIMBS, FEET, AND SKIN.

I.—THE LIMBS.

Broken Knees.

Cause.—A fall. Horses first brought from a stable are liable, from no fault in their build, to stumble and fall through excitement. They are also apt to tread on a rolling stone and fall. A horse that stands over—*i.e.*, whose fore legs are too far under him—and those that shuffle along without lifting their feet, owing to the formation of the shoulder, are very liable to fall forward.

Treatment.—Wash with warm water and remove the dirt. Apply a linseed-meal poultice to allay inflammation; after twelve hours remove the poultice. If a yellow kind of oil exudes from the wound, it shows that the joint has been cut into, and a veterinary surgeon alone can deal with the case, which, to say the least, is a desperate one. If, however, there is no yellow joint-oil to be seen, wash the wound with a weak solution of carbolic acid, or boric acid, 1 part; water, 30 parts; adjust the injured pieces of skin, apply a piece of carbolised tow, bandage with carbolised gauze, and so dress twice a-day. Keep animal tied up until the knees are healed. If fever runs high, give every four hours in gruel a draught containing salicylate sodium, 3 drs. Purgative (No. 19) may be useful if the health of the horse is affected.

Capped Hocks,

or a swelling on the point of the hock, which does not often cause lameness, but is shown by the swelling and tenderness on the point of the hock.

Cause.—Often caused by striking a closing door or gate, but may be due to kicking.

Treatment.—Foment with hot water and bathe with cooling lotion (No. 7); give complete rest till cured. Apply blister (No. 4) if the swelling has a tendency to harden. If this swelling is neglected it may prove incurable.

Capped Elbow.

A hard swelling at the elbow, varying in size.

Symptoms. — Rarely lameness; the swelling is hard, and about the size of a large hen's egg.

Cause.—It is caused by the heel of the shoe in lying, which either irritates or squeezes the skin at the elbow, and sets up inflammation.

Treatment.—If observed when only commencing, treat as for capped hock; but if left until it gets confirmed and callous, even blisters and setons are of little use. Then it may have to be removed by operation by a veterinary surgeon.

Curb.

A swelling on the posterior aspect of the leg below the hock, seen plainly when the horse is viewed sideways.

Cause. — A sprain of the ligament under the hock.

Treatment.—Foment with hot water and apply cooling lotion (No. 7) and a high-heeled shoe. If the swelling does not go down, apply blister (No. 4), and give complete rest. Curby hocks are natural to some horses, but once the horse reaches maturity they seldom cause lameness but are always a blemish.

Cutting or Brushing.

The names given when a horse strikes the inside of the fetlock with the shoe of the other foot. Horses with feet turned out are most liable to this defect. It is often brought on by fatigue or by working a young horse too soon.

Treatment. — Make the shoe fit the hoof of the cutting foot, which should be rasped on the inside to reduce it. Foment the swelling caused by the bruises, and apply lotion (No. 7). See remarks on "Speedy Cut" (p. 459).

Enlargement of the Hock.

Arising from inflammation.

Cause.—A sprain or a blow, such as a kick by another horse: it produces great lameness.

Treatment.—Foment with hot water, apply lotion (No. 7), and give perfect rest. Purgative (No. 19) will help to

relieve the inflammation, or a draught in gruel, containing salicylate sodium, 3 drs., every four hours.

If any enlargement remains when the inflammation is reduced, apply blister (No. 4). The object in view must be to prevent a permanent enlargement of the hock.

Fractures

are divided into simple, compound, and compound comminuted fractures.

A simple fracture is when the bone is broken into two pieces, compound when broken and associated with a wound, and a compound comminuted when broken into several pieces and associated with a wound.

In the horse simple fractures are the only ones worth trying to treat. In the case of the other two kinds, the sooner the animal is destroyed the better.

Before trying to set a fractured limb, it is wise to consider whether the animal is worth it, and if placed in slings will he be quiet. Having decided to set the limb, place the animal in slings; take some gutta-percha, place it in hot water, and mould it to the limb, or use some sheet-tin, and after moulding it to the part, cover with some flannel to prevent its cutting at edges. Take the splints thus made, place them on the part to be set, and pack where they do not exactly fit with tow, then take a nice long bandage, wind it tightly around, and do not touch it for a couple of months.

If the animal is a restless one, it will be only wasting time to try and set the limb. It is a false but popular idea that horses' bones will not unite; nothing will unite quicker, if the animal will only nurse its limb.

Grease.

A disease of the skin of the heel, generally of the hind feet.

Symptoms.—Inflammation, with pain and lameness at first; discharge of matter; at first limpid, soon gets thick, fœtid, and irritating; swelling; often going on to ulceration and the formation of fungus-like growths called "grapes."

Cause.—Too little exercise and too much corn; bad or innutritious food; too much coarse boiled food; washing with cold water without afterwards drying the legs, and chills caused by work in wet, muddy ground, after keeping in too warm a stable.

Prevention.—The legs of horses subject to this disease should not be washed unless they are afterwards dried. Let the mud dry on the legs, and then brush it off; it is more than probable if you do this, you will have no more trouble, provided other conditions are favourable.

Treatment. — Wash the heel with warm water and soap, or if very bad, poultice at first with boiled turnips and bran, sprinkling the sores all over with soot before applying the poultice, and rub in ointment composed of oleate of zinc, 1 part, and vaseline, 2 parts; or lard, 1 oz., sugar of lead, 1 dr.; or wash with lotion containing chromic acid, 1 part, water, 8 parts. If the case proves obdurate, use ointment containing white precipitate of mercury, 1 dr.; *liquor carbonis detergens*, 1 dr.; vaseline, 1 oz. Give a mild alterative, Barbadoes aloes, 4 drs.; Castile soap, 1 dr.; oil of caraways, 10 drops, or condition powders (No. 6). Sulphate of soda, 4 oz., in the food every night may prove a useful aperient. Iodide of arsenic, 4 grs.; liquorice-powder, 2 drs.; gentian, 3 drs., made into a ball with treacle and linseed-meal, is a very good thing for this disease, and a ball should be given every night.

Open Joints.

The following joints are sometimes opened: hock, stifle, knee, and fetlock joint.

Symptoms. — Great pain and lameness; a small wound is seen, and from it flows a yellowish fluid the consistency of glycerine.

Cause. — Kick from another horse, accidents of various kinds, and by a groom pricking the horse with his fork when bedding the animal up.

Treatment is unsatisfactory. Give a dose of physic; place a cold-water bandage around the joint for twenty-four hours; but it is better to call in a veterinary surgeon as soon as an open joint is deemed possible.

Knee-Tied.

A natural defect, for which there is no cure. It is a want of depth under the knee, owing to the hinder knee-bone not being large enough.

Mallenders and Sallenders.

Dry scurfy humours, which, when affecting the front of the hock, are called *Sallenders*, and when under the back of the knee *Mallenders*.

Cause.—Neglect in the stable.

Treatment.—Rest, and apply ointment containing tar, 1 oz.; sugar of lead, ½ oz.; lard, 4 oz.; and give draught morning and evening containing bicarbonate potassium, 6 drs.; spirits of nitrous ether, 1 oz.; tincture gentian, 1 oz.; water, 8 oz. Feed on green food and improve stable management. If the above treatment is not successful, apply a little of blister (No. 4), mixed with three times its weight of lard, and well rubbed in.

Tumours.

There are many kinds of tumours, and they may be either internal or external. The former are usually situated in the brain, womb, abdomen, and liver, and nothing within the power of man can do any good. The external tumours are the ones we are often asked to cure, and they usually appear on the shoulders, neck, under the tail, and at the end of the cord after castration.

Treatment.—There are various ways of removing them, and the best is by the knife. If the tumour is narrow at its base, an easy and safe way to remove it is by winding a piece of green silk tightly around its base and allowing it to drop off. In cutting large tumours out, veterinary surgeons sometimes come in contact with large arteries, and these must be caught up and tied. When a tumour appears after castration, use the hot iron and clams to remove it.

Rheumatism.

Change of temperature and cold often produce stiffness of the joints, varying in intensity.

Treatment.—Keep the animal warm, and rub the part affected with liniment of belladonna, and morning and evening give in ½ pint of water iodide of potassium, 1 dr. It might be necessary in extreme cases to apply blister (No. 1).

Rupture of the Suspensory Ligament.

Lameness from this cause is generally incurable. The suspensory ligament sustains the foot, and the rupture of it allows the fetlock to drop down almost to the ground. If the horse cannot bend his foot, it is not the suspensory ligament that is ruptured.

Cause.—Over-exertion or strain.

Treatment.—Perfect rest, and put on a high-heeled shoe. Bandage the legs,[1] foment, and apply lotion (No. 7); if this does not reduce the swelling, apply blister (No. 4) and give a mild purgative (No. 19).

In most cases the lameness will be permanent.

Hip Knocked Down.

Symptoms.—At first great swelling, the animal goes lame, but when the swelling is reduced the hip that is knocked down looks less than the other when looking at it from behind.

Cause.—Through falling, in knocking against a wall, in passing through a doorway.

Treatment.—Little can be done except placing the animal in slings, and bathing the part with hot water; if an abscess forms, the piece of bone that is knocked off must be cut down upon and removed.

Spavin.

There are two kinds:—

1. *Bone-Spavin.*

Symptoms.—Bony enlargement on the inside of the hock-joint towards its antero-inferior aspect, producing lameness when first formed, till the parts accommodate themselves to the enlargement. Afterwards, the lameness may be apparent only when the horse is first taken out of the stable, unless it interferes with the movement of the joint, when a small spavin may permanently lame a horse.

[1] The frequent bandaging of the legs is apt to produce an unsightly curliness of the hair. The application of alum, 1 oz.; salt, 2 oz.; in 1 quart of water, will do much to remedy it.

Cause. — Hereditary, local injury, sprains of the ligaments and concussion, overwork when young, peculiar formation of hock, and improper shoeing.

Treatment.—Perfect rest and repeated application of blister (No. 4). Should blistering not remove the lameness, firing may have to be resorted to. I have found ossoline effect a cure when other remedies fail. Spavins always constitute unsoundness.

2. *Bog-Spavin.*

Symptoms. — A tumour, resembling a wind-gall on the hock, formed on the inside of the front of the hock. The swelling is due to distension of the bursa of the hock with joint-oil, and is usually permanent, but does not much interfere with slow work.

Cause. — Sprain and over-exertion. Hereditary conformation.

Treatment.—If it is not considered advisable to keep the horse for slow work without treating the spavin, which, in my opinion, is the wisest course to pursue, apply blister (No. 3) and allow perfect rest, in the hope of effecting a cure, but it is not likely to be permanent.

Speedy Cut.

Horses are apt to strike the inside of the fore leg at the lower part of the knee with the other foot when trotting fast, or lifting their feet high. Horses liable to this are dangerous to ride or drive, the force of the blow being sufficient in some cases to bring them down. Great pain and inflammation and swelling result from the blow.

Prevention.—Cut the hoof away on the inside, and put on a shoe of equal thickness at toe and heel, having only one nail on the inside, and not projecting beyond the part of the hoof which has been rasped. Keep a speedy cutting boot on the injured leg to protect it.

Treatment. — Foment the bruise, apply lotion (No. 7), and allow complete rest till cured. If the bruises have a tendency to harden, apply blister (No. 4).

Wounds.

Wounds are divided into abrasions, incised, punctured, contused, and lacerated wounds.

An Abrasion.

Caused by falls, kicks, barb-wire, and short nails, &c.

Symptoms.—The skin is torn, but the wound is not of any depth.

Treatment.—Wash well with warm water, dress with tincture of myrrh, and dust fuller's earth over it.

Incised Wounds.

Caused by a knife, scythe, or any sharp instrument.

Symptoms.—The wound usually is deep, and the edges cleanly cut.

Treatment. — Having thoroughly cleansed the wound, sew it up with carbolised gut, and dress with *liq. carbonis detergens*, 1 oz. to 30 oz. of water.

Punctured Wounds.

Caused by long nails, horns of cattle, forks, parts of agricultural implements, and broken shafts.

Symptoms.—A wound of some depth, and though it may not be large to look at, it is the most fatal of all wounds.

Treatment.—If it is bleeding freely, plug it up for some hours with carbolised tow; after the tow is removed, inject into the wound, by the aid of a wound-syringe, the following lotion: glycerine, 3 oz.; carbolic acid, 1 oz.; water, 30 oz.; and keep in the wound a piece of tow soaked in the lotion until it heals. Remember, wounds of this kind must heal from the bottom.

Contused Wounds.

Caused by a severe blow, fall, or kick.

Symptoms.—This is more of a bruise than a wound.

Treatment. — Bathe for two hours twice a-day, and afterwards dress it with lotion (No. 7).

Torn or Lacerated Wounds.

Caused by a bite from a dog or horse, by being entangled in a fence and struggling, and in coming against the latch of a door in passing through it.

Symptoms.—A wound usually of some size with its edges ragged.

Treatment.—Cleanse the wound well with hot water, sew up any part you think necessary, and dress with *liq. carbonis detergens*, 1 part; water, 30 parts.

Splint.

Symptoms.—A bony enlargement on the inside of the fore leg below the knee. It often produces lameness until fully grown, when the lameness usually disappears, unless the splint interferes with a tendon or joint. Splints are not thought much of unless near a tendon or joint.

Cause.—Young horses are very subject to splints: they arise from injuries to, and a sudden weight thrown upon, the bones of the legs, and usually found on the inside of the canon-bones of the fore legs.

Treatment.—Blister (No. 4) applied once or twice will generally effect a cure. As a horse gets older splints will generally disappear.

Sprain of the Back Tendons.

Symptoms.—Great pain, thickening and inflammation in the leg above the fetlock, preventing the horse bringing his foot flat to the ground. The leg will appear to be round instead of flat.

Cause.—Inflammation of the sheath which encloses the back tendons, the result of hard work or excessive strain.

Treatment. — Perfect rest; foment with hot water and then poultice with linseed-meal and bathe with lotion (No. 7); keep the bowels open with purgative (No. 19). When the heat subsides, and the horse can put his foot flat to the ground, bandage the leg with bandages steeped in vinegar. Should the inflammation continue, apply embrocation (No. 12), or blister (No. 3), and give two or three months' complete rest.

Sprain of the Coffin-joint.

Symptoms. — Sudden lameness, and heat and tenderness round the coronet.

Treatment. — This kind of sprain should be treated at once, before the inflammation spreads. Apply blister (No. 3), and give occasionally purgative (No. 19). Bandage the leg and give perfect rest.

Sore Shins.

Only common in young horses that have been put too suddenly to work.

Symptoms.—Lameness; if both legs are affected, the animal rests first on one then on the other leg, and the legs have a doughy feel.

Cause.—By a young horse galloping before the bones are properly developed.

Treatment.—Put cold-water bandages on for a few days, and then blister with (No. 1).

Sprain of the Fetlock.

Symptoms.—Lameness, attended with swelling, heat, and tenderness of the fetlock, is probably a sprain of the fetlock.

Treatment.—Apply repeatedly blister (No. 3) till the heat subsides, then bandage lightly to strengthen the fetlock; give perfect rest.

Sprain of the Round Bone or Hip.

Symptoms.—A sprain in connection with the rounded bone of the thigh, by which the horse loses all power of moving that quarter, and drags his leg, resting it on the toe alone.

Cause.—Sudden strain, slip, or fall.

Treatment.—Foment and apply immediately blister (No. 3), and call in a veterinary surgeon.

Sprain of the Shoulder.

Symptoms. — Great pain, especially when going down-hill, and a dragging of the foot forward on the toe. If the foot is drawn forward, the horse shows pain. No outward swelling or heat.

Cause. — Accident from slipping or going over rough ground. Young horses are very liable to this.

Treatment.—Perfect rest; apply hot fomentations to the shoulder and bathe with lotion (No. 7), and, if necessary, blister (No. 3); keep down inflammation by giving purgative (No. 19). A long rest, combined with this treatment, will generally effect a cure.

Shoulder-Slip.

A peculiar outward movement of the shoulder when the animal walks, sometimes, but not always, accompanied by lameness.

Symptoms.—The shoulder-joint looks enlarged, but the muscles of the shoulder are wasted.

Cause.—By horse being put to plough too young; by the one foot being in the furrow and the other out, and by pulling

awkwardly and using the shoulders unequally before getting accustomed to the draught. Injury to the supra-scapular nerve sufficient to cause more or less paralysis.

Treatment.—Blister the shoulder with (No. 1), and turn the animal out to grass for three or four months.

Sprain of the Stifle-joint.

Symptoms. — Dropping of the hind quarters and dragging of the leg; great heat, swelling, and tenderness of the stifle.

Cause.—A blow, slip, sprain, or overwork.

Treatment.—If the stifle has been dislocated from a kick or blow, send for a veterinary surgeon, who alone can judge as to the treatment. In case of sprain, apply warm fomentations and lotion (No. 7) till the inflammation is somewhat reduced, and then apply blister (No. 3); give perfect rest and purgative (No. 19).

Dislocation or Luxation of the Patella.

This disease is usually seen in young horses, and is due to the slipping outwards of the patella or bone which corresponds to the lid of the human knee.

Symptoms.—One or both stifles may be wrong, the joint looks swollen, and when the animal moves it slips out and in with a peculiar noise.

Cause.—Hard galloping, feeding on hilly pasture, and often a disease of the joints occurring in foals.

Treatment.—In young horses, seems to be of little use; but blisters may be tried. If the swelling is accompanied by heat and pain, apply hot fomentations and cooling lotion first. In older horses it can be reduced by flexing (working backwards and forwards) the leg; push the patella back into its proper place, and apply a blister.

String-halt.

Symptoms.—A sudden snatching up of the hind leg or legs, but usually only one leg, which makes the horse's action peculiar. Probably a nervous disease, and practically incurable. It produces no lameness, but is liable to get worse, and is always considered unsoundness.

Cause.—Often produced by rheumatism or by leaving a horse standing in a stable without sufficient exercise, and is hereditary.

Treatment.—Doses containing citrate iron, 2 drs.; and ammonium, 2 drs.; tincture nux vomica, 2 drs.; tincture capsicum, 2 drs.; carbonate of ammonium, 2 drs., given in water night and morning, may relieve and strengthen the system with satisfactory results.

Mud-fever.

Symptoms.—Heat and swelling of the legs, and the animal moves stiffly; there is a certain amount of fever, hence the name.

Cause. — The chilling and irritant action of mud, which in cold weather produces inflammation in the legs of horses, especially when the legs are rendered tender by clipping, repeated washing, and imperfect drying.

Prevention.—Do not clip the horse's legs; let the mud dry, and then brush it off; never wash them in frosty weather.

Treatment.—Dress the legs with a mixture of glycerine, 8 oz.; carbolic acid, 1 dr.; and *liq. plumbi acet.*, 1 oz.

Swelled Legs.

Horses of a coarse nature are very subject to swollen legs, especially the hind ones.

Symptoms.—With or without great heat; lameness accompanied by quick pulse and fever, but there may be neither fever nor lameness.

Cause—Overfeeding, too little exercise, and change of food.

Treatment.—If there is much fever, foment the legs, bathe with lotion (No. 7), and give a ball containing turpentine, 1 oz.; ginger, ½ dr.; linseed-meal, ½ oz.; and two hours after give purgative (No. 19). If there is not much fever but swelling, stiffness, and pain in the legs, foment them and rub lightly with embrocation (No. 12). Give gentle exercise and purgative (No. 19).

Thoroughpin.

Symptoms.—Very similar to windgall (see below). An enlargement at the upper and back part of the hock between the tendon and the bone. It

usually projects on both sides of the hock, but rarely causes lameness, if taken in time before the swelling becomes callous.

Cause.—Overwork or strain.

Treatment.—Rest, and apply blister (No. 3 or 4) till the swelling is reduced.

Wind-galls.

Symptoms.—Puffy elastic swellings situated just above the fetlock, which may become large and hard, causing lameness.

Cause.—Strain of the tendons, and overwork in young horses.

Treatment.—Bandage with flannel steeped in vinegar till the swelling subsides. If this does not effect a cure, blister (No. 3) should be applied. Wind-galls do not, as a rule, cause unsoundness.

II.—THE FOOT.

Canker.

A disease of the hoof, generally commencing about the frog or heels, and often spreading over the sole.

Symptoms.—This disease is sometimes the result of neglected thrush, and differs from it in its tendency to spread, and in the swelling or enlargement of the affected parts. The diseased frog assumes a soft, fungatory appearance; is liable to bleed on being touched; emits a very fœtid, offensive, although nearly colourless discharge; and unless energetically treated the disease is apt to spread over the whole sole.

Cause.—Hereditary; but often neglect and want of cleanliness.

Treatment.—Cut away the sole where the canker is situated, removing all fungus, and apply acid solution of nitrate of mercury and bandage up the foot, or dust on iodoform night and morning; morning and night bathe with lotion—carbolic acid, 1 part; glycerine, 1 part; and in four days repeat the application of acid solution. If the fungus still grows, call in the aid of a veterinary surgeon.

Contraction of the Foot.

Symptoms.—A natural hoof is nearly circular, but sometimes through neglect or bad shoeing the hoof is made concave, and the heels contract, producing permanent lameness if not attended to.

Cause.—Neglect in stable management or shoeing. Too much paring away of the frog, bars, and sole. Extreme dryness, or allowing the shoes to remain on too long, will cause the hoof to shrink.

Prevention.—Stopping the feet with cow-dung or moist clay, and removing the shoes.

Treatment.—A contracted foot can hardly ever be cured, but if it is decided to attempt a cure, a veterinary surgeon should be called in.

Corns.

Symptoms.—The horn of the heel—most frequently the inner heel of a fore-foot—becomes reddish, soft, and tender. The horse will flinch when this part is pressed, and occasional or permanent lameness results.

Cause.—Careless shoeing or tight shoes, producing undue pressure at a particular point.

Treatment.—Old corns are difficult to cure; fresh ones may be prevented increasing by proper shoeing, and by paring the corn as far as possible without wounding the sole. A bar-shoe may be put on in serious cases with advantage, and the horse shod with leather.

False Quarter.

Symptoms.—It is due to a division of or a want of secretion by part of the coronary band, which extends as the horn grows downwards, making a fissure or wide groove in the hoof. It is a serious defect, often resulting in inflammation and lameness, and from the thinness of the horn it is very liable to injury during work.

Cause.—Injury to the coronary band, and sometimes the consequence of neglected sand-crack.

Treatment.—Apply blister (No. 5) to the coronet, and treat the fissure as for Sand-crack (see p. 464). Should the secreting coronary band be permanently injured, no remedy will cure the disease.

Laminitis—Founder (acute),

or inflammation of the feet.

Symptoms.—Great restlessness and continual shifting of the animal's weight

from one foot to the other; pain, fever, heaving flanks, hot feet. After a time the horse will lie down and will then rest quietly.

Cause. — Violent exertion on hard roads, or cold causing inflammation; feeding on wheat; unusual or inordinate feeding of any kind; from inflammation of the lungs, or bowels; or from drinking largely of cold water when overheated; putting a horse that has been idle suddenly to work, and sometimes occurs after foaling.

Treatment. — Remove the shoes, foment the feet, and poultice with linseed-meal or bran. Give a draught in gruel every six hours, containing bicarbonate of potassium, 1 oz.; Fleming's tincture of aconite, 5 drops; nitrous ether, 1 oz. Feed on mashes and green food, and keep the poultices on for three days. Bathe the feet with lotion containing ammonium chloride, 2 oz.; potassium nitrate, 2 oz., in 16 oz. water. If the inflammation continues after three days of such treatment, apply blister (No. 2) to the pasterns. In most cases the aid of a veterinary surgeon is advisable.

Laminitis—Founder (chronic).

The result of acute founder or inflammation of the foot, and nothing can cure it; shoeing may do good.

Navicular Joint Disease.

Symptoms.—A sprain of the joint made by the shuttle-bone at the back of the coffin-joint in the foot of the horse will, if the cartilage of the bone is inflamed, produce lameness. When first brought out of the stable, the horse will tread on his toes and avoid bringing his heel to the ground; consequently he will go lame down-hill; when resting he will point his feet. This lameness is very deceptive, and has often been judged to be in the shoulder.

Cause. — Hereditary; over-exercise after undue rest.

Treatment.—Foment and apply hot linseed-meal or bran poultices; and give purgative (No. 19). The early advice of a veterinary surgeon should be obtained, and he will best determine how ulceration and ossification of the cartilage can be prevented.

Over-reaching,

or wounding of the heels or coronet with the other foot.

Symptoms.—Often a clicking noise due to the hind shoe striking the fore one when the animal is moving. Often inflammation and pain; and the wound, however slight, should not be neglected.

Treatment.—Wash all dirt from the wound, apply a piece of tow dipped in friars' balsam, and tie it up. In severe cases poultice with linseed-meal or bran. If the wound does not heal, call in a veterinary surgeon.

Pricks or Wounds in the Sole.

Symptoms. — Lameness, which can probably be located by pressing all round the sole with a pair of pincers, the tender part being of course shown by the horse flinching.

Cause.—Commonly a fault in shoeing, or a wound caused by a stone, flint, piece of glass, or a nail picked up on the road.

Treatment.—Having found the tender place, pare that part of the sole down to the quick, and fill up the wound with a little tow dipped in friars' balsam. If the horse is very lame, or if the wound is festering, apply a poultice of linseed-meal or bran. If it does not heal, touch the place with chloride of antimony, which should induce the crust to form. A picked-up nail is often very dangerous, and if there is much lameness a veterinary surgeon should be called at once.

Pumiced Feet.

A result of inflammation of the feet. The exudate thrown out between the wall of the hoof and the coffin-bone during inflammation of the feet forces the latter to press downwards on the sole of the foot, flattening it and causing what is called a "pumiced" foot.

Symptoms. — Hollowness of the middle of the front part of the foot. Fulness or convexity of the sole.

Cause.—Inflammation of the foot, or very hard work, especially on hard roads or streets.

Treatment.—No cure. Blisters or stimulating dressings to the coronets may be tried, to increase the growth of

healthy horn. Care—in shoeing—that nothing presses on the pumiced part of the foot, or a bar-shoe, is the only thing that can be done.

Quittor.

A suppurating wound of the coronet, often arising from a neglected prick, a tread, or accidental injury. Wounds of this nature are very serious, and should be left to the veterinary surgeon.

Ringbone.

A most prevalent disease situated in the pastern. In the hind feet, unless the disease is found at the front of the foot, the horse will walk on his toes; in the fore feet, owing to the greater concussion, it is generally at the front and sides, and the animal will walk on his heel.

Symptoms.—Pain and inflammation, with enlargement of the bone above the coronet, generally on both sides of the pastern, which, if not checked, will spread rapidly.

Cause.—Horses having straight upright pasterns are very liable to this disease, owing to their peculiar formation. It may also be hereditary.

Treatment.—Apply hot poultices to the leg and give purgative (No. 19), repeating the dose if necessary. If there is no improvement, blister once or twice with No. 4. Firing is often resorted to with success. Complete rest for some months will be necessary.

Sand-crack.

Symptoms.—Cracks in the fore feet will generally be found on the inner side, and in the hind feet in the front of the hoof.

Cause.—Brittle nature of the hoof, previous disease, heavy work or neglect.

Treatment.—Wash the crack to clean it from gravel and dirt. If the pain and lameness are severe, it may have to be poulticed. Pare and rasp it, and apply ointment composed of oil of tar, 2 oz.; fish-oil, 4 oz.; and stop the foot with cow-dung and moist clay. By passing a red-hot iron above and below the crack, healthy sound horn may be got to grow from the top. If any growth of proud flesh appears in the crack, apply nitric acid, and blister the coronet with No. 2. Give rest and cover the crack with a plaster made of pitch, and bind the whole up firmly for five days. If the coronet has been divided, the aid of a veterinary surgeon had better be obtained.

Seedy Toe.

A disease of the foot in which an unhealthy horn is secreted that fails to maintain the connection between the horny laminæ and the wall of the hoof.

Symptoms.—There may or may not be a swelling of the wall of the foot, generally situated towards the toe; sometimes attended with lameness. If the part affected is tapped with a hammer it will sound hollow, and by paring the crack or hollow inside the wall-part of the foot the friable unhealthy horn can be found.

Cause.—Previous disease or injury, naturally weak feet, pressure of a part of the shoe, generally the clip.

Treatment.—Remove the cause, if practicable; pare away the diseased portion of the hoof, and apply blister (No. 2) to the coronet. Rest till cured. Afterwards shoe with side-clips.

Side-bones.

Symptoms.—Somewhat similar to Ringbone (p. 464), except that the disease is located above the heel; it is an ossification of the lateral cartilages of the foot. Usually found in heavy draught-horses, and in the fore feet rather than in the hind feet. If the horse has good, well-developed feet, they do not generally cause lameness.

Cause.—Concussion and hereditary predisposition; bad shoeing.

Treatment.—Apply blister (No. 5); if this does not cure the lameness, have Professor Smith's operation performed on the foot by a veterinary surgeon; some of the well-known patent specifics may be tried with a chance of success.

Thrush.

A disease of the frog, which secretes a semi-fluid fœtid matter.

Symptoms.—A discharge of matter from the cleft of the frog. There is not often lameness, and the disease can be detected only by the matter exuding from the frog. If thrush is neglected, it

will increase, the frog will become soft, ragged, and split up, the horn will disappear, and canker of the sole may supervene.

Cause.—Generally excessive moisture in the bedding, bad stable management, and constitutional predisposition.

Treatment.—Give purgative (No. 19), clean the frog thoroughly, and pare away all loose horn, apply a lotion to the frog, composed of carbolic acid, 1 part; glycerine, 6 parts, and place tow moistened with this lotion in the cleft of the frog every night. If possible, remove the cause of the disease. It is not necessary or expedient to turn the horse out to grass.

Weakness of the Foot.

Generally a fault in the make of the horse. Sometimes the result of disease. A well-formed foot should be at an angle of 45° from the coronet to the toe; a weak foot will be perhaps 36° to 40°, which is not sufficient to bear the pressure required. No cure for this defect, but careful shoeing may have a palliative effect. Rasping the wall of the hoof and paring too much off the heels is often the cause of this complaint.

Firing

is a painful operation often unnecessarily performed, for many of the horses that are fired are as lame after the operation as they were before. Firing was at one time greatly in vogue, but, like bleeding, it is getting out of fashion, and by-and-by horses with fired legs will be rare. It is thought by some that the lines in firing act as a permanent bandage to the weakened part: such is not the case, but firing does act as a counter-irritant of a severe kind.

Before you resort to firing, blister your horse once or twice, and give it a three months' run at grass; then if it comes up lame, think about firing; but remember there are some cases of lameness that nothing will ever cure.

There are two kinds of firing—lines and dots: line firing is the best for curbs, ringbones, and the back tendons; the dots are preferable for splints and spavins.

Having clipped the hair off the part to be fired, secure your animal, take the iron and make the lines at first superficial, then with a fresh iron deepen them, but never go through the skin in line firing; afterwards rub blister in, and tie the animal's head up for forty-eight hours.

Blistering.

Clip the hair off the chosen part, and rub the blister in for at least ten minutes, then tie the animal up for twenty-four hours.

III.—THE SKIN AND ITS DISEASES.

Hide-bound.

A want of oily matter, which produces hardness of the skin, giving the coat a rough look. It shows that the digestive organs are out of order, and is not so much a disease of the skin itself.

Treatment.—Give purgative (No. 19), and afterwards daily in the food condition powder (No. 6). Powerful tonics should be avoided.

Lice

may be destroyed by applying a lotion composed of tobacco, 4 drs., in a pint of hot water, or by using an ointment composed of white precipitate of mercury, 1 part, lard, 12 parts, well rubbed in. It is best to clip the horse before applying these dressings. Cleanliness and nourishing food will prevent their reappearance.

Mange or Itch.

Symptoms. — Loss of hair, itching, tenderness, and scurfy eruption, from which matter issues. When the scab falls off, a larger blotch will appear. It generally begins at the root of the mane or on the neck.

Cause.—Stable neglect, dirt, and contagion, it being due to the presence of animal parasites — small insects called *Acari*.

Treatment.—Give purgative (No. 20), and rub the places with ointment composed of sulphur, 1 oz.; lard, 1 oz. If this does not effect a cure, add to the ointment 30 grs. of white precipitate of mercury. This disease is often very obstinate, and patience must be exercised. A little salt should be given with nourishing food, and the skin kept clean,

using warm soap-and-water for the purpose. Complete isolation is necessary. Wash the stable, harness, brushes, &c., with solution of chloride of lime, 1 pint in 3 gallons of water, before they are used again.

Ringworm.

Symptoms.—A parasitic fungus, which affects the skin in circular patches; the hair comes off, leaving a dry and scaly eruption.

Cause.—Contagion, neglect, or dirt.

Treatment.—If the animal is in high condition, or in a disordered state, give purgative (No. 20), but if not, give nourishing food, and keep him clean and isolated from other animals. Rub the fungus with ointment composed of oleate of mercury, 1 part; lard, 2 parts, till cured. Clean the stable, harness, brushes, &c., with water containing 1 pint of chloride of lime to 3 gallons of water before they are used again.

Nettle-rash or Surfeit.

Symptoms. — Large pimples, disappearing as quickly as they come, which spread from the neck to different parts of the body.

Cause.—Exposure to chills, or drinking cold water when hot.

Treatment.—Give in a pint of water 2 oz. of spirits of ether and 1 oz. of tincture of ginger, and then treat the same as for Hide-bound (p. 465).

CATTLE.

DISEASES AFFECTING THE HEAD, EYES, MOUTH, AND NERVOUS SYSTEM.

Inflammation of the Brain.

May arise from violence, disease, or as an effect of poisons.

Symptoms.—Great pain and moaning, slow respiration, eyes red, loss of consciousness. Attacks of delirium, and the beast becomes ungovernable till stupefaction results, accompanied by extreme weakness; at length death ensues.

Cause.—Violence, exposure to great heat, want of water, overdriving; sudden change into a rich pasture.

Treatment.—If the beast is in fair condition you should slaughter it at once. If not, give linseed-oil, 2 pints; croton-oil, ½ dr., and three times a-day, in gruel, hydrate of chloral, 1 oz.; bromide of potassium, 1 oz.; and apply ice or cold water to the head. If the animal survives the first stage, blister the crown of the head and sides of the neck with No. 22. Most probably the animal will never recover.

Paralysis.

There may be palsy of the half, or any part, or of the whole of the body.

Symptoms.—The animal may lie, eat, and chew its cud as if nothing were wrong; but when you try to rouse it you will see it make several attempts to get on its legs but fails. When parturient paralysis appears before calving, it is not so serious as the form of paralysis that comes after calving or an attack of milk-fever.

Cause. — By derangement of the stomach, and is called reflex paralysis; by injury to spine, and before or after calving, and is called parturient paralysis.

Treatment. — Give purge (No. 27), and apply liniment (No. 26) to the whole length of the spine, and every night and morning give in a pint of ale the following drench: tincture of nux vomica, 2 oz.; iodide of potassium, 2 drs.; sulphate of iron, 1 dr.; turn the animal twice a-day. When paralysis appears before calving, the cow usually calves before she rises; but if it appears after calving, treatment often does little good, and if fat it may be best to kill the animal. But if a cure is to be tried, pursue the same line of treatment as before calving. Galvanism may be tried.

Thrush in the Mouth.

This usually appears as an epizootic amongst cattle in cold and wet weather.

Symptoms.—Small pimples and vesicles appear on the tongue, lips, and about the mouth; they break and form ulcers, but these ulcers soon heal. There is not much danger in this disease, though a little fever often exists.

Treatment. — Give purge (No. 28); wash the mouth out with alum-water, 1 part of alum to 30 of water, and give night and morning, in a pint of water, 1 oz. of salicylate of soda.

Lockjaw or Tetanus.

A disease which seriously affects the nervous system, producing contraction or spasm of the muscles.

Symptoms.—Sluggishness, and for some days increasing difficulty in mastication and swallowing, till the jaws become almost closed. The contraction of the muscles will then extend to the head, neck, and shoulders, and appear to cramp the whole body. Constipation. Recovery is very doubtful.

Cause.—Generally some wound or blow affecting a muscle, or exposure to cold. Contagion and the access to a wound of the specific organism of the disease, the bacillus of Nicoläier or drumstick bacillus.

Prevention.—If this disease is suspected, give in gruel Epsom salts, 1 lb., and Fleming's tincture of aconite, 10 drops.

Treatment.—Any treatment must be prompt to be efficacious. A veterinary surgeon should be called at once.

Cancer of the Tongue.

This disease, though not often suspected, frequently exists, and the teeth are usually blamed for it; but the disease now known as actino-mycosis is often mistaken for cancer.

Symptoms.—The animal is unthrifty, off its food, frothy saliva flows from the mouth, and it quids its food. On examining the mouth you find the tongue hard in places, and slightly swollen.

Treatment.—As soon as it is detected, kill the animal, or else it will gradually starve to death. The enlargements on the tongue, caused by the presence amongst the tissues of the parasitic fungus known as the actino-myces, are sometimes successfully treated, if not too far advanced, but they should be left to the veterinary surgeon.

Dishorning and Broken Horns.

On the subject of the dishorning of cattle the following conclusions were adopted by Tennessee Agricultural Experimental Station: "(1) For removing the horns, an ordinary meat-saw is perfectly satisfactory. (2) The horns should be removed as close to the head as possible, without cutting the skull proper. The sawing should be done rapidly, and with long sweeps of the arm if possible. (3) Animals one and two years of age appear to suffer considerably in dishorning. The painful effects decrease with increase of age, so that an animal of ten years old may suffer but very little. This is owing to the layer of flesh surrounding the base of the horn, which is much thicker in young than in old animals. Dishorning causes an abnormal increase of pulsation and temperature, which extends over several days. The appetite is also affected during the twenty-four hours succeeding the operation. (4) Dishorning is more especially to be recommended for those animals that are of vicious temperament, that are what are termed 'masters'; to be applied to bulls and to beef animals that are kept quiet and closely stabled or shipped. (5) From evidence quoted from other sources, it appears that dishorning is not necessarily a cruel practice, but may be conducted to promote ends that are both humane and desirable in live-stock breeding. Mr Sadler, British Consul at Chicago, reports that in his very extensive district the system of dishorning or dehorning cattle is rapidly increasing. Some farmers have dehorned their whole herd. It has been calculated that 200,000 cattle and horses die each year in the United States from horn-thrusts. The advocates of the system of dehorning claim that, besides lessening this loss and that of human life, much shed-room is saved, less hay is consumed, there is less turmoil from restive animals, and that cows, being more quiet and docile, give more milk.

"In the case of calves, the horn is extracted by a gouge or punch when two or three months old, and with full-grown animals the horn is sawn off at the point where the matrix joins the bone horn, and should be done early in the spring. If sawn higher up, the horn grows again; if below, the process of granulation would not take place."[1]

Destroying Horns in Calves.

In young calves, when the horns are felt causing a projection under the skin,

[1] *Veterinary Journal*, November 1888.

they can be prevented growing by the application of a caustic solution which can be obtained from most agricultural chemists.

Broken Horns.

If the horn is severely crushed, it is best to amputate it; but in cases where it is only torn or broken off, wash clean, smear some Archangel tar over it, wrap some tow around, and take a long linen bandage and wind around the horns in the figure-of-8 style.

Ophthalmia. Inflammation of the Eyes.

The symptoms and treatment of the diseases affecting the eyes are practically the same as those given in the section on Horses (see p. 442).

Growth on Eyeball.

There is sometimes seen in cattle a growth on the eyeball. Should this be causing trouble, so that its removal is deemed necessary, a veterinary surgeon should be applied to.

DISEASES AFFECTING THE THROAT, CHEST, AND RESPIRATORY ORGANS.

Abscesses.

Symptoms.—Frequently large lumps appear on the side of the jaw or on other parts of the body. In time they burst and discharge a large amount of matter, often affecting the health of the animal.

Cause.—Generally a blow, prick, or other injury.

Treatment.—A mild purgative (No. 28) should be given in gruel, and the abscess should be fomented with hot water, and opened as soon as it is ready. If making little or no progress, it should be rubbed with blister (No. 22). Tonic (No. 29) may be given in a pint of warm ale morning and evening when recovering.

Anthrax or Splenic Apoplexy.

A contagious and very dangerous disease which affects all animals, and is also inoculable to man.

It is most common in cattle, but is also met with in horses, pigs, and sheep.

Cause.—It is due to the presence of a micro-organism, the *Bacillus anthracis*, in the blood and tissues. The origin of an outbreak is generally obscure, and foreign feeding-stuffs and imported bone manure have been blamed for introducing it. Although contagious, it is not infectious, and seldom spreads from the farm or herd in which an outbreak occurs.

Symptoms.—Very often the first thing observed is that an animal is found dead, and frequently there is some bloody discharge about its nostrils and anus. If seen alive, there is great dulness and depression, high temperature, the head often low and the back a little raised; the abdomen appears full, as a rule, and there may be some shivering about the flanks or shoulders.

In the horse, there is generally swelling about the throat, which may extend down the neck towards the breast; and in the pig often a great swelling from ear to ear.

Serious outbreaks have frequently been caused by the thoughtless slaughtering of affected animals, and allowing the blood to be scattered about—the blood being the chief means of spreading the disease. When a case of anthrax is suspected,—according to the law,—the owner must at once give notice to the police, and take means to isolate the animal, so as to prevent other animals coming in contact with it. A veterinary inspector is sent to inquire into the case, and if anthrax is found to exist the carcase has to be cremated, or buried without the skin being cut, six feet deep, and covered with a thick layer of lime. The inspector will see that the place and everything connected with the case is thoroughly cleaned and disinfected.

Black-quarter or Quarter-ill.

A disease which has been known as affecting young cattle for a very long time, and was scarcely considered contagious until it was proved experimentally. It is generally confined to animals from three months to two years old, and very often the best thriving one in a lot is the victim. All ruminants are thought to be liable to it, but it is only common in cattle.

Cause.—It is due to a micro-organism, the *Bacillus Chauvœi*, rather smaller than the anthrax bacillus, and, unlike the latter, is never found in the blood during life, but only in the tumours and effusions.

Symptoms.—Very like those of anthrax, but there is usually either lameness or the appearance of a swelling on some part where it does not cause lameness. The swelling, at first hot and painful, rapidly enlarges, and begins to crepitate on pressure—*i.e.*, it contains gas. There is generally constipation, and often the animal goes down and refuses to rise.

Treatment.—This is not of much use. It is almost invariably fatal. A strong dose of Epsom salts and common salt may be given when first seen. Some recommend that the tumour should be fomented with very hot water, freely incised, and turpentine and other antiseptics smartly rubbed into it. Unlike anthrax, the flesh seems quite harmless to dogs, pigs, &c.

Prevention.—Some farms seem liable to this disease, and the calves used to be bled, physicked, and setons put in their dewlaps every season. Now a process of inoculation is used, and can be applied by your veterinary surgeon. It is generally well spoken of, but has sometimes given unfortunate results. Plenty of rock-salt within reach of the young stock, and an occasional dose of salts and nitre, will do them good.

Cattle Plague or Rinderpest.

A contagious, infectious, eruptive fever, and the most serious epizootic disease to which the ox is liable.

It seems to find its home in Central Asia, and is always present in India.

The last serious outbreak of it in Britain was in 1865-66, when it spread over most of Britain, and caused the loss of cattle to the value of several millions sterling.

Cause.—It is presumably due to an ultra-microscopic organism possessed of great virulence, as the disease spreads rapidly from animal to animal.

Symptoms.—High fever, dulness, staring coat, maybe shivering, discharge from eyes and nose, appetite lost, and milk arrested. There is generally constipation at first, followed by a fœtid diarrhœa. The most distinctive symptom is redness of the mouth and nostrils, an eruption appears in small spots over which the mucous membrane becomes shed in bran-like scales.

Treatment.—No treatment is permitted.

Prevention.—Owing greatly to its extension southwards from Egypt after 1890, until it spread practically over all the African continent, wild ruminants dying from it as well as domesticated, many attempts were made to find some satisfactory means of prevention. Now an immunising serum for inoculation has been obtained, serum institutes established both in Egypt and India, and the serum is prepared and distributed under Government supervision. Although the disease cannot be "stamped out" by means of the serum, yet its propagation can be wonderfully controlled and restrained.

Choking.

Very often cattle get pieces of turnips or linseed-cake into their throat or gullet, especially if the turnips are cut in large pieces.

Symptoms.—Animal ceases to feed, nose poked out, saliva flows from the mouth; the animal in time becomes hoven, and frequently dungs. If it is choked by a piece of turnip, you can smell it in the breath, and if the piece is near the larynx there may be coughing.

Treatment.—Give a little linseed-oil very slowly. If this does not pass it on, you must use the probang. In using this instrument you must first place the gag in the animal's mouth, and have it held there by two men, who cross their hands, holding the gag in one and grasping a horn with the other,—and be sure that the animal is held steady, its head and neck as straight as possible and in line with the body; then take the probang, oil it well, and gently pass it down the throat, until you reach the offending body. Do not use much force in passing it into the stomach, for it is an easy thing to rupture the gullet. If it cannot be moved by the probang, the veterinary surgeon should be called in, although if the hoven is extreme it may be necessary to tap the rumen at once with a trocar to permit the gas to escape.

Cold or Common Catarrh.

Symptoms.—Dulness; running discharge from the nose; cough; watering eyes; loss of appetite.

Cause.—This common complaint is most frequently met with in spring and autumn; it arises from exposure to draughts and from chills caught in wet weather. If neglected, it will lay the foundation of serious coughs, inflammation of the lungs, and other formidable diseases.

Treatment.—Epsom salts, 1 lb., and ginger, ½ oz., may be given at first in warm gruel; afterwards, morning and evening, in gruel, solution of acetate ammonia, 4 oz.; bicarbonate of potassium, 1 oz.; spirit of chloroform, ½ oz. All drinking-water to be given with the chill off; and feed on bran-mashes and green food.

Sore Throat or Quinsy.

Inflammation of the mucous membrane of the throat, or of the tonsils.

Symptoms. — The animal refuses to feed, pokes its nose out, breathes hard, and makes a peculiar noise in the throat.

Cause.—Cold and an insanitary condition of the byre, associated with bad feeding.

Treatment.—Blister with No. 22, and place a piece about the size of a bean of the following every three hours between the molar teeth: extract of belladonna and chlorate of potash of each an ounce, and made into a paste.

Cough.

Cause. — Neglected colds are apt to develop into coughs which are difficult to cure. Cold caught when the system is relaxed, as is the case with cows after calving, may take the form of a cough which will settle on the lungs and produce serious consequences.

Treatment.—Keep the animal warm; give water in which linseed has been boiled for drinking purposes, and morning and evening, in gruel, draught (No. 25).

Foot-and-mouth Disease.

Aphthous fever. A contagious and infectious eruptive fever, and the most typical epizootic disease affecting the domestic animals.

All ruminating animals are subject to it, and also the pig, whilst the horse and other animals are sometimes affected.

Cause.—It is due to the presence of an ultra-microscopic organism, which has never been demonstrated, but which has practically been proved to exist, and there is no doubt it is only communicated from animal to animal by contagion and infection.

Symptoms.—Fever, often high fever, and sometimes shivering. Soon there is a profuse discharge of saliva which hangs in strings from the mouth, and the animal smacks its lips. There is also a shaking of the feet as if it wished to get rid of something irritating them. If the mouth is examined small bladders or vesicles will be seen on the lips, in the mouth, and on the gums and tongue. Small ones may also be seen on the teats and udder, and on the scrotum in the male. It is the same thing which causes the sores at the front and back of the cleft of the hoof, but seldom observed until they burst and look raw and sore. When the vesicles in the mouth burst the smacking of the lips stops, and red, raw-looking spots are seen. The sores on the teats of milch cows almost prevent milking, and there is danger of inflammation of the udder. After the animal is recovering the hoofs are shed gradually in all the worst cases.

In the sheep it is not generally so bad; the mouth is seldom so sore, but the sores at the feet may form all round the top of the hoof, and do not appear only at the front and back as in the ox.

In the pig the feet lesions are worst; and pigs moved about or sent per rail at the height of the disease may lose their hoofs altogether.

Calves sucking their dams, while suffering from the disease, often die suddenly. Adult animals seldom die from it in this country, but it causes immense losses through destroying the udders of dairy cows, causing abortions and great loss of condition.

Treatment.—A dose of physic at the start, see that their feet do not get wet or dirty, cleanliness and astringent antiseptic washes for the sores, and the provision of suitable food. But the Board of Agriculture does not permit treatment now.

Prevention. — Isolation and strict police measures.

Hoose or Husk

is a peculiar disease produced by the thread-worm or lung parasite of cattle—the *Strongylus micrurus.*

Symptoms. — Peculiar husky cough, wheezing, loss of condition, and death, if means are not taken to destroy the thread-worms in the bronchial tubes. In the later stages of the disease there is much slimy mucus about the mouth and nose. It is very prevalent among calves and growing stock during the late summer when in the fields, and especially so in the autumn when the weather is wet. The cough is particularly noticeable if the animals are chased.

Cause — Prevention. — The losses caused by these parasites render it most important that every care should be taken to keep animals likely to be affected free from the influences calculated to invite an attack. These parasites frequent low, marshy, and undrained ground. During a wet season many kinds of grass-land will be found to contain them. Calves and young stock should be kept in good condition, and, if possible, during the autumn should be housed at night, and not turned out till the dew is off the grass. When animals are allowed plenty of food there is not much risk of the disease, so that young calves should get plenty of milk or other suitable food, and older animals trough food, as crushed grains and cake with some common salt in it.

Treatment. — Stock in the autumn should be daily examined, and upon the first sound of husk the affected beast should be attended to. Give daily to a calf turpentine, ½ oz., beaten up with milk and an egg; keep him well, giving linseed-porridge; and if the calf is young, new milk. In the case of older cattle, give morning and night turpentine, 1 oz., in six times the quantity of sweet oil. I have tried applications of tar to the animals' noses, but it does no good. A new method of treating this disease is to inject remedies directly into the windpipe, but this should be left to a competent veterinary surgeon.

Bronchitis.

Inflammation of the small air-tubes of the lungs.

Symptoms. — Animal dull, breathes quick and short, fits of coughing, and, on placing the ear against the chest, a peculiar wheezing noise is heard.

Cause.—Cold, exposure to wet, and allowing medicine to get into the windpipe in the act of drenching an animal.

Treatment.—Remove to a warm box, throw a couple of sacks over its back, rub each side of the chest with embrocation (No. 12), and give in a pint of gruel twice a-day (No. 25).

Inflammation of the Lungs or Pneumonia.

Symptoms.—Dulness, loss of appetite, cough dry and hard, rapid breathing, hot mouth, very cold ears, horns, and feet, slimy discharge from mouth.

Cause.—Exposure to cold and sudden chills.

Treatment. — Remove into a cool loose-box, and give every six hours, in a pint of gruel, Fleming's tincture of aconite, 20 drops; solution acetate of ammonia, 4 oz.; spirits of nitrous ether, ½ oz. Feed on mashes and green food; rub the chest with blister (No. 23). If the bowels are costive, give in gruel Epsom salts in 1-lb. dozes. Clothe with rugs or sacks about the shoulders and chest.

Influenza or Epizootic Catarrh.

Symptoms. — All the symptoms attending common colds are intensified in the more serious form of influenza. Profuse discharge from eyes and nose, painful cough, obstinate constipation, fever, followed by equally obstinate diarrhœa; swellings about the head, accompanied by great weakness. Usually the disease runs through a herd, and is attended with considerable loss among the cattle.

Cause.—Influences of climate, which seem to make the disease an epizootic.

Treatment. — Isolate the affected beasts. Give linseed-oil, 1½ pint, followed by gruel to drink; if constipation continues, give enemas and every six hours a draught containing acetate of ammonium, 4 oz.; bicarbonate of potash, 1 oz.; spirit of chloroform, ½ oz. Keep the body warm, and for drinking purposes give water in which a little linseed has been boiled. Feed on mashes and green food.

Murrain or Malignant Catarrh.

Symptoms.—This disease, which is one of the most fatal to which cattle are subject, usually begins with a cough, followed by heaving flanks, shivering, tenderness over the loins, horns cold, dung hard, black, and fœtid, bloody matter running from the nose. As the disease advances, blood is mixed with the dung, and the breath becomes offensive. Great weakness sets in, the mouth becomes ulcerated, till finally the beast dies, a mass of corruption.

Cause.—Not well known.

Treatment.—If this dreadful disease is suspected, completely isolate the beast; give every four hours, in warm gruel, salicylic acid, 3 drs.; tincture of cinchona, 2 oz.; brandy, 4 oz., till the opinion of a veterinary surgeon can be obtained, who will decide whether to slaughter the beast or not.

Contagious Pleuro-pneumonia of the Ox.

A contagious and infectious disease affecting cattle only. It has now been stamped out in Great Britain after proving a perfect pest to the farmer and stock-breeder for over fifty years.

Cause.—A very minute micrococcus which can only just be made out under the highest powers of the microscope.

Symptoms.—A short husky cough is often the first symptom, but if the temperature is taken it will be found that fever is present. As the disease progresses the cough becomes more marked, especially when the animal is hurried or excited, the breathing is more frequent, and there is a distinct lift at the flanks. When punched over the ribs the animal may grunt, and it may seem pained on movement.

But it may require a post-mortem examination to distinguish the disease. When the chest is opened there may be a considerable amount of fluid in it, and the lungs and pleura covered by a yellowish white membrane; but the disease may all be on one side. In old cases the lung may be adherent to the ribs. Part of the lung or lungs will feel solid, and when cut into presents a characteristic marbled appearance, the sections varying in colour through pink, greyish, different shades of red, to almost black, and separated by yellowish veins up to about half an inch broad.

Treatment is not now required in Britain, and

Prevention is obtained by keeping it out of the country.

Tuberculosis—Consumption.

This almost ubiquitous disease is more commonly known as consumption when affecting the chest in man than when met with in the lower animals. In some of its various forms it is also known as "struma" and "scrofula," and animals affected by it are often called "piners" and "wasters."

This is the most widely spread and destructive disease to which animals are liable, and nearly all animals are subject to it.

Cause.—It is due to a very fine bacillus, the *Bacillus tuberculosis*, or bacillus of Koch, as it was first discovered by Professor Koch of Berlin in 1882. Prior to that time the disease was believed to be strongly hereditary, and that over-crowding, bad hygiene, and privation led to its development. These are now considered predisposing causes, but many still think that a hereditary tendency to it may exist in some individuals. Although tuberculosis cannot exist without the presence of the bacillus, it is now recognised by scientists that there are different varieties of the *Bacillus tuberculosis*. There is the "human type," which is commonly the cause of tuberculosis in man; the "bovine type," which is the cause of tuberculosis in cattle; and the "avian type," which is the cause of tuberculosis in fowls. Although these differ from each other in several respects, yet the differences are not sufficient to cause them to be considered as distinct species, but only as different varieties of the bacillus of Koch.

At the London Conference of 1901 Koch gave it as his opinion that human and bovine tuberculosis differed so much that it was scarcely possible to communicate the latter disease to man, and that owing to this the presence of tubercle bacilli in the milk and flesh of bovine animals might be disregarded.

Owing to the eminence of Koch as a scientific pathologist such a declaration

could not be ignored, and a Royal Commission was soon after appointed to investigate the matter.

The second interim Report of the Commission was published in 1907, and states: "There can be no doubt but that in a certain number of cases the tuberculosis occurring in the human subject, especially in children, is the direct result of the introduction into the human body of the bacillus of bovine tuberculosis; and there also can be no doubt that in the majority of these cases the bacillus is introduced through cows' milk. Cows' milk containing bovine tubercle bacilli is clearly a cause of tuberculosis, and of fatal tuberculosis in man."

Although the bacilli of bovine tuberculosis seem to be more virulent when inoculated to other animals — experimental animals — than the bacilli of human tuberculosis, it does not follow that this is the case when inoculated or communicated to man. It seems rather the opposite, and many scientists seem to doubt whether tubercle bacilli of the bovine type ever cause acute tuberculosis of the lungs — often called phthisis or consumption—in the human subject.

Symptoms. — These are often very indefinite: an animal if well cared for and kept in good condition may be full of tubercles without manifesting any symptoms of illness. Sometimes an animal—often a young one—will begin to make a rough noise in breathing, especially when eating with the head down. This is often due to disease with enlargement of the glands about the throat. Sometimes they will bulge externally below the ears or about the lower jaw, burst and discharge matter. Often a cow, especially if a heavy milker, is inclined to become lean, then a dry short cough is heard, she soon looks unthrifty, gradually emaciates, the cough becomes worse, diarrhœa may set in, the skin seems to adhere to the bones, the appetite is impaired, and she becomes a confirmed piner. Sometimes a young animal will become lame, and it is thought to have been injured, a joint may be observed swollen, it continues to enlarge, and turns out tubercular. A quarter of a cow's udder may feel a little hard, but it continues to give milk, and little is thought of it. It, however, still grows harder, but is not very painful, and milk is secreted in fair amount. This is generally in a hind quarter, and is at length found to be due to tuberculosis. There is scarcely an organ or tissue but may become affected, sometimes tumours — diseased glands—will appear near the point of the shoulder or about the flanks, and in a bull a testicle may become enlarged,—all due to tubercle. In the horse it is not very common, and the symptoms are often vague. There is not very often a cough, but he seems weak, breathless on exertion, and unfit for his work; he loses appetite, but drinks plenty, and often urinates much more than usual. He becomes dry and open in his coat, rough and scaly on his skin, and acquires an unthrifty appearance.

It is thought that horses often contract the disease from mixing with cattle, or from being reared on cow's milk.

Pigs are frequently affected. The disease may spread from pig to pig, but is often due to diseased offal about slaughter-houses and the refuse from creameries. A growing pig may become lame, and one or more joints enlarge. Or it may begin to cough, to be less keen for its food, diarrhœa may result, it loses condition, and tumours may appear in the region of the throat.

Treatment. — It is scarcely worth while treating an animal with tuberculosis. Still, if an animal in fair condition is suspected, it should get every attention and the most nourishing food to enable it to be sent to the butcher as early as possible, in the hope that the carcase may be free of the disease and fit for human food.

Prevention.—There is no subject connected with the health of animals (or of man either) receiving so much attention at the present time (1909) throughout the civilised world as the suppression of tuberculosis, and in no country, as far as animals are concerned, is less being done in that direction than in Britain. Except in the form of carcases or meat intended for human food, and in the case of cows, the milk of which is offered for public sale, no restriction or control whatsoever is exercised by Government in connection with the disease. It is a big

and difficult question, but the time seems approaching when the Board of Agriculture will be obliged to take action regarding it.

Meanwhile the breeder and stock-owner must rely on his own knowledge and initiative. A very considerable aid to its suppression is the fact that it is now very generally recognised as contagious. As soon as any breeder has reason to suspect that an animal may be affected with the disease it should be rigorously isolated, and its stall or box cleaned and disinfected. And should a veterinary surgeon pronounce the illness to be due to tuberculosis, unless the animal is in a condition to be rapidly fattened, it should be destroyed. On no account should it be again returned to the herd. There is no doubt but breeders can clear the disease out of their herds by the use of tuberculin, and keep it out, at less expense than it will cost them in loss and illness if no means of any kind are used to prevent it.

Many scientists in different parts of the world have for years been trying to obtain some reliable means of prevention. Von Behring, a German, has prepared several kinds of serum, one at least of which, he affirmed, when inoculated into animals rendered them immune or insusceptible to the disease, but it has been extensively tried in Argentina, under Government auspices, with very questionable benefit. At the present time the most successful method of conferring some degree of immunity on animals is by the intravenous injection of cultures of human tubercle bacilli, and that will require some time yet before it is applicable on a commercial scale. Meantime the breeder should foster the health, the vigour, and robustness of his herd. Never allow an animal to get into low condition; see that there is sufficient air-space, light, and ventilation in the byres, and that young and breeding animals are turned out for a short time every day unless the weather is very bad. The weaklings should never be retained in the herd. If there is any appearance of delicacy or lack of robustness let them go. It does not matter how fine a pedigree an animal may have, if there is neither vigour nor stamina it should not be in a breeding herd.

DISEASES AFFECTING THE STOMACH, LIVER, BOWELS, KIDNEYS, AND INTERNAL ORGANS.

Bloody Flux, see *Dysentery* (p. 475).

Colic or Gripes.

is of two kinds.

1. *Flatulent Colic.*

Arising from retention of food in the third stomach and bowels.

Symptoms. — Fever, moaning and pain; discharge of gas from anus, distention of the abdomen, restlessness.

Cause.—Errors in dieting, green food, being turned out to grass too suddenly in the early summer, especially if a cold day.

Treatment.—Give purgative (No. 27) in gruel, and every four hours, in gruel, solution of ammonia, 1 oz.; spirit of chloroform, 1 oz. Give gentle exercise, and rub the belly with liniment (No. 26). Clysters of warm water may be necessary. Feed on mashes and gruel.

2. *Simple Colic.*

Symptoms. — Spasmodic attacks of pain, increasing in violence. Irritability, and constant striking of the belly with the hind legs or horns; continual restlessness.

Cause. — Chills from drinking cold water when heated; improper food.

Treatment.—Give linseed-oil, 1 pint, repeating the doze if there is costiveness; and every four hours give in gruel: oil of turpentine, ½ oz.; tincture of opium, 1½ oz.; spirits of nitrous ether, 2 oz. Walk the animal about. In obstinate cases send for a veterinary surgeon, and in the meantime rub the belly with liniment (No. 26).

Costiveness or Fardel-bound.

Symptoms. — Excessive costiveness; dung hard, but at intervals loose and slimy. Frequently the abdomen will become distended, and inflammation follows.

Cause.—Excess of dryness in the food, or the peculiar properties of some kind of underwood often eaten by cattle. Often also a symptom of some other disease.

Treatment.—Give linseed-oil, 1 pint; and warm oatmeal-gruel, in which ½ oz. salt has been mixed. If this does not act, give, in gruel, purgative (No. 27), and, if necessary, a warm clyster of gruel and ½ oz. salt.

Foreign Bodies in the Rumen.

Some cows at times suffer from depraved appetities, and pick up almost anything that comes in their way. Leather, wire, cutlery, rags, &c., have been found in the paunch of an animal.

Symptoms.—They are not very noticeable, and an animal might have a foreign body in its paunch for months without feeling any inconvenience from it, but if the foreign body passes into any vital organ, symptoms such as loss of appetite and colicky pains are soon noticed.

Treatment.—Nothing can do any good in the shape of medicines; if you suspect there is something in the stomach that should not be, consult your veterinary surgeon on the case.

Diarrhœa.

Symptoms.—A frequent discharge of fluid dung mixed with mucus, which soon causes great weakness.

Cause.—Change of food, especially when moved from a poor into a luxuriant pasture. Bad water or atmospheric influence, amounting almost to an epizootic.

Treatment.—Give linseed-oil, 1 pint; tincture of opium, 1½ oz.; oil of turpentine, ½ oz., and repeat the doze, if necessary, which will remove any cause of irritation in the intestines: till this is done, no astringent should be given. When the oil has cleared the system, give morning and evening, in cold gruel: powdered opium, 2 drs.; catechu, 4 drs.; galls, powdered, 4 drs.; prepared chalk, 1 oz. Looseness of the bowels, unattended with pain and weakness, should not be regarded as serious, provided it can be accounted for by change of food; it should be carefully watched, and steps taken to prevent its assuming too violent a character.

Dysentery or Bloody Flux.

Symptoms.—Continual and obstinate purging, the animal is hide-bound, eyes pale, pulse weak, extreme weakness. In time the dung appears like undigested food, and water with clots of blood in it.

Cause.—Internal inflammation from neglected diarrhœa or the eating of poisonous plants.

Treatment.—Clothe warmly, foment and rub the belly with liniment (No. 26). Feed on gruel made of oatmeal and linseed, with 4 oz. of starch and 1 oz. nitre in it. Give three times a-day in gruel: ipecacuanha, 1 dr.; chlorodyne, 40 drops; opium, 2 drs.; chalk, 1 oz.; galls, 2 oz. Give also cold clysters of oatmeal-gruel; and laudanum, 2 drs. This disease is most dangerous and almost hopeless.

Hoove, Hove, or Hoven,

or distention of the rumen by gas, owing to the food being retained in the stomach so long that it begins to ferment.

Symptoms.—Swelling of the belly; heavy breathing; moaning and unwillingness to move. As the gas is evolved, the stomach becomes further distended,—there is even danger of the paunch bursting; the circulation of the blood is impeded; gradually suffocation sets in, till at length the beast falls and dies.

Cause.—Overloading of the stomach so that it is unable to react on its contents, greedy feeding on green food, feeding on clover before the dew is off it, hence it is often termed "dew-blown."

Treatment.—In desperate cases the only cure is to relieve the stomach by means of a stomach-pump, which will be almost beyond an ordinary breeder of stock. In cases of sudden emergency, an incision into the paunch behind the short ribs with a penknife will give relief. A trocar and canula should be used if it can be got. In ordinary cases give at once in a pint of water hyposulphate of soda, 4 oz., repeating the dose till relief is afforded. When recovering, Epsom salts, 1 lb., and ginger, ½ oz., may be given, and but little food allowed till the digestive organs have recovered their strength.

Impaction of the Paunch or Grain-sick.

This disease is seen when animals are allowed to gorge themselves with such foods as succulent grass, chaff, potatoes, turnips, and grains.

Symptoms. — Animal dull, refuses food; disinclined to move and generally lying down; greatly swollen on the left side, but, unlike hoove, it has a doughy feel.

Treatment. — Give purge (No. 27), and with it 1 pint of linseed-oil and 2 oz. of tincture of nux vomica; if this fails, you must get a veterinary surgeon, who may require to perform an operation to remove the contents.

Inflammation of the Bowels.

Symptoms.—Restlessness, pain, perspiration, hard breathing, quick pulse.

Cause.—Sudden chills in hot weather, as from drinking a great quantity of cold water when overheated, most common in working oxen.

Treatment.—Give, morning and evening, linseed-oil, ½ pint; spirits of nitrous ether, 1 oz.; tincture of opium, 1 oz.; and repeat the dose of spirits of nitrous ether and tincture of opium in a little gruel every four hours; very careful feeding on sloppy foods and gruels.

Dropsy of the Abdomen or Ascites.

An accumulation of fluid in the abdominal cavity.

Symptoms. — The beast increases slowly in size; the swelling is on both sides and on the lower part of the abdomen; as the fluid increases the breathing becomes hurried, belly hangs low, the animal looks thin, and if you force your fist against the side of the belly, you feel the impulse of the returning water against it.

Cause.—Debility and organic disease of the liver or spleen.

Treatment.—The chance of success in treatment is not great, for, unless the cause can be removed, the only thing to be done is to tap the abdomen with a trocar and canula to let the fluid out, and if it again accumulates the case is hopeless.

Inflammation of the Fourth Stomach.

Symptoms. — Uneasiness, pawing of the ground, striking at the belly with the feet, showing where the pain is located; dung thin and offensive; pulse hard and quick; breathing accelerated; alternately hot and cold shivering fits.

Cause. — Unwholesome or poisonous food; change from a poor to a rich pasture; prolonged indigestion.

Treatment.—Feed on bran-mashes, but no green food; give linseed-oil, 1 pint; and every six hours, in gruel, tincture of opium, 2 oz.; Fleming's tincture of aconite, 12 drops; spirit of chloroform, 1 oz. The belly may be frequently rubbed with liniment (No. 26).

Gut Tie.

It is only seen in castrated animals, and generally terminates fatally.

Symptoms.—It is usually seen at the age of two or three, rarely before. The animal at first appears dull and loses its cud; after a time colicky pains appear, it strikes its belly with hind legs, goes stiff, breathing becomes hurried, the animal wears an anxious expression, no medicine seems to do any good, and in a few days it dies in great agony.

Cause.—The cord of the testicle encircling a portion of the small intestines and strangulating it.

Treatment.—There is only one thing to be done, and that is an operation by a veterinary surgeon, opening the abdomen in the right flank, and liberating the constricted gut.

Inflammation of the Kidneys.

Symptoms.—Straining to void urine, which is forcibly ejected in small quantities; loins tender and hot. After a time blood and pus may be mixed with the urine and the straining increases; muzzle becomes dry, horns cold, breathing quick. Diarrhœa follows, dung becomes fœtid; pain increases, total suppression of urine takes place, and the animal will die in about three days.

Cause.—Unwholesome food or a chill which has produced inflammation in this particular part.

Treatment.—Foment the loins with hot water, and rub in mustard mixed with water; give clyster of warm gruel with 2 oz. salt in it, adding tincture of opium, 1½ oz., if straining continues. Give at once, in gruel, purgative (No. 27), and three times a-day give, in gruel, a draught containing Fleming's tincture of aconite, 12 drops; solution acetate of ammonium, 3 oz.; and tincture of opium, 1 oz.

Inflammation of the Liver (Yellows or Jaundice).

Symptoms.—Yellowness of the eyes and skin; pulse quick; ears and horns hot; muzzle dry; shivering of the right side; stiffness, fulness of the belly; pain when the right side is pressed; urine and dung light brown in colour.

Cause. — Over-fattening; driving in hot weather; injury to the body near the liver, impeding circulation and inducing inflammation.

Treatment. — Give in warm water purgative (No. 27), and feed on bran-mashes. Morning and evening give in warm water chloride of ammonium, 4 drs.; bicarbonate of potassium, 1 oz.; ginger, 4 drs. Keep free from draughts. The animal should be sold when occasion offers; it is never likely to do well after the attack.

Flukes in Liver.

Cattle, like sheep, suffer from flukes in their livers, but not so severely, and it is rarely discovered until their death.

The reasons for cattle not suffering so severely as sheep are—firstly, they do not feed so close to the ground, and thus pick up fewer fluke-eggs; and, secondly, their livers are larger, and can stand the ravages of the fluke better.

Loss of Cud.

Symptoms.—Very often cattle do not chew their cud properly, and a great quantity of saliva dribbles from their mouth.

Cause.—Indigestion.

Treatment. — Change the food, and give a dose of linseed-oil, 1 pint, and, in the case of a calf, give oatmeal-porridge with bicarbonate of soda, 1 dr., night and morning. A little salt given with the food will help to remedy the evil.

Poisons.

The poisons that cattle principally suffer from are yew, rhododendron, arsenic, mercury, and lead.

Yew-poisoning

is perhaps most frequently met with.

Symptoms are those of a virulent poison, and is rapidly fatal, often shivering, cold extremities, staggering; the animal may fall and die rapidly in convulsions, usually in a few hours.

Cause.—By animals being allowed to graze in the vicinity of yew-trees, when they will often crop the tops of the growing twigs, or by the trimmings of these trees being thrown within their reach.

Rhododendron-poisoning.

Symptoms. — This poison is not so quick in its action; the animal staggers, becomes partially paralysed, colicky pains; animal lies and moans and frequently vomits, the vomit being greenish in colour.

Cause.—Same as yew.

Treatment.—The treatment of these two vegetable poisons is identical. Open the rumen and remove the poisonous stems and leaves, then give purge (No. 28) and half a pint of brandy in some water every three hours.

Arsenic-poisoning.

Symptoms.—Great prostration, shivering, colicky pains, diarrhœa, and death.

Cause.—In being given by accident, and by grazing on land where recently dipped sheep have been lying.

Treatment.—Give the following in a pint of water every hour: the hydrated peroxide of iron. Calcined magnesia is also a chemical antidote. The white of eggs given raw, and powdered charcoal, are also useful.

Mercury-poisoning.

Symptoms.—Flow of saliva from the mouth, breath fœtid, gums red and tender, colicky pains, and appetite lost.

Cause.—By dressing cattle with mercurial preparations to cure mange, ringworm, and warbles.

Treatment. — Give purge (No. 28) with half a dozen eggs, and follow every two hours with iodide of potassium, 2 drs.; opium powder, 2 drs., in gruel. Sulphur and sulphate of iron are believed to be useful.

Lead-poisoning.

Symptoms. — Animal dull, abdomen tucked up, eyes staring, unsteady gait, bowels constipated, swelling under jaw, and emaciation. In acute cases blindness and delirium.

Cause. — Grazing near smelting furnaces or rifle-butts, and by eating lead-paint or sheet-lead.

Treatment.—Use the stomach-pump, afterwards give oils, flour-gruel, skimmed milk, and in a pint of cold water sulphuric acid dil., 3 drs. Give every three hours the following: iodide of potassium, 2 drs.; sulphuric acid dil., 3 drs.; 3 eggs; and half a pint of water.

Red Water.

When in an acute form, it is often called Black Water.

Symptoms. — The first thing that draws attention to the animal is usually the red colour of the urine, which froths when it falls to the ground; this is generally accompanied by diarrhœa or scouring, which soon gives way to constipation. The urine gets darker, the appetite fails, the animal gets weaker, and the heart can frequently be heard beating while standing behind the animal. Death often ensues within three or four days.

Cause. — It is not very well known. It is most common in milk cows, occurring generally from ten to fifteen days after calving, and is most common on moorland soils, and where there is a wet retentive subsoil. But in some districts when it is very common it attacks bulls, oxen, and heifers as well, and at all seasons. In this form there is now every reason to believe that it is due to a micro organism which is met with in the blood of affected animals, mostly in the red corpuscles. It was first described by Messrs Smith and Kilborne of the Bureau of Animal Industry of the United States as being the cause of Texas fever, a very fatal disease occurring in cattle in the Southern States. They called the organism the *Pyrosoma bigeminum*, and proved that the disease was not directly contagious as had previously been thought, but that it was communicated to animals by the bites of ticks.

Prevention. — Careful feeding after calving, a limited supply of turnips, some linseed-cake, and other foods allowed. Thorough draining and manuring of the land, the destruction of ticks, and the cutting down of all rank, coarse grass and ragweed which would give shelter to the ticks.

Treatment. — If observed before the appetite and rumination are diminished, give in gruel: Epsom salts, 16 oz., and ginger, ½ oz., but not otherwise; and morning and evening give tincture of perchloride of iron, 1½ oz.; spirit of chloroform, ½ oz., in gruel, and give milk, raw eggs, and stimulants if appetite lost.

Bleeding.

Cattle are bled from the following veins: jugular, the vein below the eye, and the milk-vein. The jugular is usually opened in cases of milk-fever, apoplexy, &c., and is easily got at on either side of the neck. First raise the vein by placing a cord tightly around the neck close to the shoulders, turn the neck a little to the opposite side, and a sharp blow will send the fleam through the skin into the vein. The fleam should be a size larger than that used for a horse. Afterwards, close the wound with a pin, and twist tow or a clean worsted thread around it. The vein below the eye is opened with a lancet in cases of inflammation of the eye, and the milk-vein in cases of inflammation of the udder. Two quarts of blood is a fair quantity to take from an animal.

DISEASES AFFECTING THE GENERATIVE ORGANS.

Abortion.

Symptoms. — When abortion takes place in the early stages of gestation, as it often does in the second month, the symptoms are very slight, and may be unnoticed, especially in the summer when the cattle are at grass. In the later stages of gestation the symptoms are easily recognised. There is restlessness and derangement of health, the udder becomes enlarged, accompanied by calving pains, and discharge from the vagina. But frequently the first symptom is the appearance of the calf.

Cause.—There is so much uncertainty connected with this disease, that it is sufficient to remark here that blows, injuries, exposure to cold, improper food, foul smells, and overdriving are the most immediate causes. But there are some forms of abortion that, once started in a

herd of cows, are to all appearance communicable by contagion.

Prevention.—Careful attention, pure clean water, and the removal of any existing injurious influence will do much to make the occurrence of the disease rare. A goat allowed to run amongst the cows is said to be a good preventive. Have the cow isolated as soon as observed, before abortion if possible, and attend to the thorough cleansing and disinfection of everything with which the calf or the discharges could have come in contact.

Treatment. — Should any symptoms of abortion appear, give Epsom salts, 12 oz.; Fleming's tincture of aconite, 10 drops; chloral hydrate, 1 oz., in a pint of warm water, and repeat the dose of aconite in a half-pint of water three times a-day if there is no improvement. Bury the fœtus at once, and if it takes place in a field, remove any cattle in it to another pasture.

Calving, see *Parturition* (p. 481).

Cow-pox.

Symptoms.—Small vesicles followed by pustules on the teats, which, when numerous, may produce inflammation and affect the health.

Cause.—Constitutional, and contagion from other cows, carried by the milker's hand.

Treatment.—Give purgative (No. 28); keep the teats clean, and bathe them with goulard water, or chloride of lime, ½ oz., dissolved in half-gallon of water. The sores will soon heal.

Gonorrhœa or Bull-burnt.

This is a contagious disease of the genital organs, and is propagated through copulation.

Symptoms.—In the cow a glairy discharge is seen coming from the vulva a few days after being bulled; kicking and restlessness on urinating. In the bull this discharge is seen issuing from the penis.

Treatment. — Inject into the vagina twice a-day a little of the following, after syringing with lukewarm water: *liquor opii sedativus*, 1 oz.; sulphate of zinc, ½ oz.; water, 1 quart. In the case of the bull, it must be injected into the sheath. Give the animal purgative (No. 28) now and then to keep its bowels open. Sexual connection must not be permitted until all risk of contagion is gone.

Falling Down of the Calf-bed.

Symptoms.—After calving, the womb sometimes followe the calf, and hangs down like a large red bag.

Treatment. — Remove the cleansing carefully if it is still attached, clean the womb with lukewarm water and return it as soon as possible. Give a draught in warm gruel containing tincture of opium, 2 oz.; chloral hydrate, 1 oz.; spirit of chloroform, 1 oz. Raise the animal higher behind than in front. Afterwards place a truss on the animal to keep it in.

Flooding after Calving.

A flow of blood from the womb.

Cause.—Rupture of some of the vessels of the womb through using force in extracting a calf.

Treatment. — Keep the cow higher behind than in front; place ice or cold-water cloths across the loins; give every three hours in a pint of cold water the following: tincture of perchloride of iron, ½ oz.; tincture of opium, 1 oz.; and tincture of ergot, 2 oz.

Garget,

or inflammation of part of the udder.

Symptoms.—This is a very serious disease, and usually affects one quarter of the udder, sometimes two, and if the inflammation is not reduced, the milk will become discoloured, or matter may collect in the udder instead of milk, the health become affected, and the cow may be lost.

Cause.—Careless milking; too hasty drying of the cow; injury to the udder; lying on cold wet land in the autumn.

Prevention. — Should there be any appearance of the disease, the calf should, if possible, be put to the mother, and it may, by its sucking and bumping, relieve her of the pressure of milk and disperse the hardness.

Treatment.—Should the disease become established, draw off gently all the contents at frequent intervals, and apply

light poultices to the bag, containing belladonna, 3 drs. Give four times a-day, in gruel, nitre, 2 drs.; bicarbonate of potassium, 1 oz.; Fleming's tincture of aconite, 10 drops. Should ulcers form and break, they should be dressed with lotion containing carbolic acid, 1 part; water, 20 parts.

Overstocking or Hefting.

This is not a disease, but the consequence of the cruel practice of placing an elastic band around the teats, or plugging them up with grains of barley, and not milking the animal for twenty-four to thirty-six hours, with the result that the animal arrives in the market with a beautiful udder, and the owner tries to get more for the cow than she is worth. The results of overstocking produced in this way are intense suffering of the animal, inflammation of the udder, and a permanent interference with the secretion of milk, and it undoubtedly comes under the heading, cruelty to animals.

Hard Udder.

Cows' udders frequently become hard, especially with heifers after their first calf.

Symptoms.—Swelling and inflammation.

Treatment.—Rub a little goose-grease on the udder after each milking, with a good deal of gentle rubbing, and if there is much tenderness give purgative (No. 28) in gruel.

Bloody Milk.

Symptoms.—Generally the first and only symptom is the presence of blood in the milk, and it is very often confined to one teat. The udder may neither be hard nor painful. This disease is especially prevalent among young cows after the first calf.

Cause.—Injuries to the udder; congestion of the gland structure and rupture of some small vessel; sudden change to a rich milk-producing diet; chills; too hasty drying of the cow; careless milking, &c.

Treatment.—Give Epsom salts, 1 lb.; nitre, 1 oz.; and ginger, 1 oz. Follow with tonic (No. 21). Milk the affected teat or teats into separate vessels.

Warts on Teats.

These little but troublesome things can easily be removed by winding green silk around them and allowing them to drop off; or by cutting them off with a pair of scissors, afterwards touching the parts with nitrate of silver. They should be attended to when the animal is dry.

Inflammation of the Womb.

Symptoms.—After calving, inflammation of the womb sometimes sets in, causing fever and loss of milk, and usually accompanied by a fœtid discharge from the uterus; but sometimes the discharge is suppressed. There is generally pain, fever, stiffness, straddling gait, and straining.

Cause.—Generally injury done during parturition, either from violence used in the assistance given, dirty hands or dirty instruments, or otherwise. High condition and improper rich food induce a tendency to this complaint.

Prevention.—A fortnight before calving, a cow's diet should be reduced to the simplest character. If the condition of the beast is very high, Epsom salts, 1 lb., and ½ oz. ginger in gruel; or a pint of linseed-oil, given a few days before calving, will do much to ensure safe recovery.

Treatment—If there is difficulty in passing urine, the aid of a veterinary surgeon should be at once obtained. In the first stages of the disease give a warm clyster containing tincture of opium, 2 oz. If constipation, give a bottle of linseed-oil with a gill of whisky, and if necessary follow with purgative (No. 27) in half-doses till the bowels are opened; then give every six hours in gruel, salicylate of sodium, 4 drs.; tincture of opium, 1½ oz.; solution acetate of ammonium, 4 oz. Feed on mashes, and be careful not to allow the animal to get a chill.

Leucorrhœa or the Whites.

Called so from the colour of the discharges.

Symptoms.—The cow is unthrifty, and a white discharge runs from the vagina, especially when she coughs or lies down.

Cause.—From injury to the womb,

usually after difficult calving or retention of the cleansing.

Treatment.—Give tonic (No. 29) night and morning in a pint of ale; inject into the vagina, by the aid of a syringe, the following twice a-day: sulpho-carbolas of zinc, ½ oz.; water, 1 quart; and feed the animal well.

Parturition or Calving.

The natural presentation of a calf is with the muzzle resting above the fore legs, with the back of the animal upwards. In cases of unnatural presentation, assistance will always be required. Every endeavour should be made to get the calf into a proper position. Experience and skill in extracting the calf are more needed than mere force. Every care must be taken not to wound the cow.

No description within the scope of the present treatise could give a proper idea of the methods used in all cases of unnatural presentation. The aid of an experienced surgeon must therefore always be obtained if the case is beyond the knowledge of the man in charge. Two or three hours after calving it may be prudent to give, in warm gruel, purgative (No. 28). Shortly after calving the cleansing or after-birth should come away. If retained twenty-four hours, with no appearance of coming away, it should be carefully removed before decomposition is too far advanced, as it very often sets up a septic or putrefactive inflammation; but if not removed, a draught in gruel containing Epsom salts, 8 oz.; powdered ergot, 1 oz.; carbonate of ammonia, 4 drs., should be given every day, unless diarrhœa supervene, until it appears. Should decomposition actually commence, the hand must be introduced, and the placenta removed as gently as possible. But it is wise to call in the veterinary surgeon.

Dropsy of the Womb.

An accumulation of fluid in the womb, and is often mistaken for pregnancy.

Symptoms.—The cow looks as though she were pregnant; but when her time is up—that is to say, if she has been to the bull—she shows no sign of calving, and if you place your hand up the rectum nothing but a huge water-bag can be felt.

Treatment consists of tapping the womb and allowing the fluid to escape, and should be left to the veterinary surgeon.

Milk-Fever (Dropping after Calving).

Symptoms.—After calving the cow will appear restless, muzzle hot and dry, udder tender and hot, constipation. Increasing weakness, ending in death, if the treatment is not successful. Sometimes cows have been known to suddenly drop down a few hours after calving without the herdsman previously knowing that anything was wrong.

Cause.—The origin of the disease is as yet not satisfactorily settled; there are many opinions, the enumeration of which would occupy too much space to be profitable for our present purpose.

Prevention.—A fortnight before calving keep the cow on a spare diet, composed in winter of bran-mashes and other opening food; a little linseed meal or cake will help to keep the bowels open. After calving, it has always been my practice to give a drink of thin gruel with 12 oz. Epsom salts in it; and should any signs of derangement appear, add Fleming's tincture of aconite, 10 drops; repeating the dose of aconite every six hours should signs of restlessness continue.

Treatment.—Try and not let the animal injure herself dashing about. When down and unconscious, keep her propped on to her breast with her legs under her in as natural a position as possible.

The treatment of this disease has been quite revolutionised since Schmidt of Kolding, Denmark, published his method of treatment by injecting the udder, in 1897. He used a solution of iodide of potass, ½ dr., in ½ pint of boiled water, into each quarter of the udder. But since that time many medicines have been used, and it is found that the injection of pure aseptic air is very satisfactory. The udder is distended to its fullest and massaged by the hand. Little other treatment is required, and the recoveries by this method, when the cases are taken in time, and the treatment carefully and satisfactorily applied, are about 90 per cent. But great care is required to have everything aseptic, as it is

very easy setting up inflammation of the udder, and the cow may recover from milk-fever to die of mammitis. It is therefore advisable to obtain the services of a veterinary surgeon when possible.

Sore Teats.

Symptoms.—After calving, cows are liable to have sores or small cracks or chaps on the teats, making them very tender and painful.

Treatment.—Apply boracic acid ointment or lotion to the teats, having previously bathed them with warm water to remove all scabbiness and dirt. Dry dressings sometimes do better, as oxide of zinc and powdered starch.

Suppression of Urine.

Cows in calf are very subject to this complaint, in consequence of the pressure caused by the calf. It is also a symptom of several other diseases.

Treatment.—Keep the bowels open, by giving in warm gruel purgative (No. 28), assisted by a clyster of warm gruel, and give till relieved, morning and evening, in gruel, tincture of perchloride of iron, 1 oz.; spirit of chloroform, ½ oz.

DISEASES AFFECTING THE LIMBS, FEET, AND SKIN.

Foot-and-mouth Disease.

(See p. 470.)

Foul or Fouls in the Feet.

Symptoms.—Cattle are very liable to this disease of the foot, which produces great lameness. There is a good deal of fœtid discharge from the cleft of the foot, also swelling of the pastern.

Cause.—Driving over rough roads or for long distances; injury from a prick, nail, or splinter; standing on moist and dirty bedding.

Treatment.—Put the beast into a dry, clean place. Dress down the diseased hoof with a knife, and wash with hot water and soda. If there is pain and fever, and the lameness excessive, poultice for some days to reduce the inflammation. Then dress the foot with a mixture of tar and powdered sulphate of copper. Should much swelling of the pastern with some lameness remain, apply blister (No. 23). If there is a wound in the foot caused by a splinter, remove the splinter, apply a hot poultice of linseed-meal, and bind up the foot.

Enlarged Knees.

Cows in byres frequently suffer from an enlargement on the front of the knee through lying on the stony floor.

Treatment.—If there is much pain and swelling, apply warm fomentations assiduously, and cooling lotion (No. 7). See that the knees are protected from the hard floor and from the manger.

Lice.

Symptoms.—Cattle in poor condition often lose their hair, especially on the neck and back, owing to their being infested with lice.

Cause.—Want of cleanliness and poor condition.

Treatment.—Wash the part affected with lotion made from tobacco, 4 drs., dissolved in 1 pint of hot water. Ointment made of lard, 6 oz., white precipitate of mercury, ½ oz., is a certain remedy, but requires careful handling. Improve the quality of the food and keep the animal clean; give tonic (No. 29).

Mange.

Symptoms.—Itching, loss of hair, scurf, scab, or sores, especially on the back.

Cause.—It is caused by a small insect (an *Acarus*); it is favoured by dirt, poverty of the blood, and neglect, and is very contagious when animals get into contact.

Treatment.—Improve the food given, and keep the animal clean. Rub the places affected with ointment composed of sulphur, 1 oz.; lard, 4 oz.; give in gruel mild purgative (No. 28), adding sulphur, 1 oz. If this does not effect a cure, wash the places with corrosive sublimate, ½ oz.; muriatic acid, 1 oz.; soft water, 2 quarts; or by the treatment recommended for lice.

Rheumatism, Lumbago.

Symptoms.—Swelling of the joints; stiffness; listlessness; unwillingness to move, which the beast does with pain.

Cause.—Cold, especially after calving or when weakened by illness.

Treatment.—Give a draught in gruel or warm water, morning and evening, containing carbonate of ammonia, ½ oz.; bicarbonate of potassium, 1 oz.; gentian, 1 oz.; ginger, 1 oz. Rub the parts affected with liniment of belladonna, 1 part, compound liniment of ammonia, 1 part. Give nourishing food and a little linseed meal or cake, and keep free from chills till quite cured.

Ringworm

is caused by a parasitic fungus growing in the skin.

Symptoms.—Loss of the hair, which comes off in circular patches, leaving a dry and scaly eruption. The face, head, neck, back, and root of the tail are the parts most generally affected.

Cause.—Contagion, neglect, and dirt.

Treatment.—If the animal is in high condition or out of health, give purgative (No. 28), and keep on nourishing food. Rub the parts affected with ointment composed of oleate of mercury, 1 part; lard, 2 parts, or use a lotion of perchloride mercury, 1 part; water, 500 parts. I have used lotions composed of sulphurous acid, but have found the mercurial ointment the most efficacious; sometimes a second application is not even necessary. Wash the cribs, rubbing-posts, &c., which have been used by a beast affected with ringworm with 1 pound chloride of lime dissolved in 2 gallons of water, to avoid spreading the disease among other stock.

Warbles.

Symptoms.—Early in the year and in the spring, from January till May, large lumps about the size of half-a-crown may often be found along the backs of cattle; these increase in size till the contents, the maggots of the bot-fly (*Œstrus bovis*), escape. There is always a small air-hole to be seen in the middle of the lump, and the head of the maggot is often visible.

Cause.—The bot-fly pierces the skin of the beast while out at grass during the hot weather in July and August, and leaves an egg at the bottom of the wound, which hatches, develops, and grows, till at length it emerges a large maggot about May or June in the following year.

Prevention.—None, except the extermination of the flies by diligent destruction of the maggots.

Treatment.—In April or May all cattle should be examined, and the maggots squeezed out between the fingers, which may easily be done, and in my opinion is the best way of ensuring their destruction. If the holes are smeared with M'Dougall's cattle-smear, the maggots are no doubt killed, but they remain in the ulcer, and certainly the most healthy way is simply to crush them out and relieve the beast of them at once.

The damage done by this fly to cattle and hides may be estimated at millions of pounds; every means should therefore be taken to remove this pest from the country.

Wounds.

In severe cases, unless the animal has a fancy value, it would be better to slaughter at once. Simple cases may be cured by bringing the edges of the skin together, and fastening them with carbolised gut and a bandage of carbolised gauze. The bowels must be kept open by doses of purgative (No. 28), and the wound kept clean by bathing with warm water if necessary.

SPECIAL DISEASES AFFECTING CALVES.

Constipation.

Cause.—Frequently the first milk or biesting from the cow has not been given to the calf, and constipation ensues. Also, when milk has been taken to excess it is apt to produce constipation.

Prevention.—In a young calf the natural first milk of the mother is most suitable, and afterwards care should be taken that only as much milk is given as the digestive organs can dispose of.

Treatment.—Give castor-oil, 1 oz., beaten up in the yolk of an egg, with ginger, 1 scr.; repeating the dose if necessary. Clysters may be required, but not so often as in young foals.

Diarrhœa.

Cause.—Injudicious feeding, and at too long intervals; bad smells, cold, acidity in the stomach, produced by any sudden change of food, or by anything which deranges digestion.

Prevention.—Care should be taken that the milk given to calves should be sweet, and that the air is kept pure.

Treatment.—If the calf refuses its food, and blood is mingled with the dung, accompanied by great pain and weakness, immediate steps must be taken to remove the irritating matter. If the diarrhœa is recent give castor-oil, 2 oz., to relieve the intestines, and after this has had time to act, give morning and evening 1 oz. of calf-cordial (No. 24). If this does not produce any effect, give four times daily, tincture of catechu, 2 drs.; spirit of chloroform, 30 drops; and dilute sulphuric acid, 30 drops, in thin gruel.

Diarrhœa, indigestion, and death are also caused by *hair balls*, which form in the stomach. There is no preventive. Caused by the calves licking each other.

Navel-ill.

Calves sometimes suck one another's navels, which causes swelling and inflammation of it; or it may be caused by the cord breaking off too short, by neglect, exposure to cold, wet, and dirt.

Treatment.—Poultice, if no tendency to bleeding, or apply hot fomentations persistently, and carbolic oil to the raw surface. A very fatal disease.

White Skit.

Whitish diarrhœa seen in calves that live on a milk diet.

Treatment.—Give castor-oil, 1 to 2 oz., according to the size of the animal, and follow up with calf-cordial (No. 24). Keep the animal for a few days on flour or oatmeal gruel.

SHEEP.

DISEASES AFFECTING THE HEAD, EYES, MOUTH, AND NERVOUS SYSTEM.

Apoplexy.

This disease cannot be treated or guarded against; it attacks the fattest sheep on the richest pastures, especially in the spring of the year. The animal seized will drop down suddenly, and in extreme cases die at once. Any animal affected should be killed immediately.

Louping-ill or Trembles.

A disease manifesting nervous symptoms.

Symptoms.—The animal trembles, breathes in a jerky manner, moves its legs in an automatic style, occasional spasms of the muscles of the neck, which usually terminate in paralysis.

Cause.—It is seen only in certain districts, and is supposed to be due to a peculiar formation of the soil or the condition of the grass. The Committee mentioned in connection with braxy, p. 486, state that the cause is a large, feebly motile bacillus, with a great tendency to form spores; that it is a regular inhabitant of the alimentary canal—the intestines; and that it is due to some change in the blood resulting in a diminution of the resisting power of the animal that the bacilli are able to pass the walls of the intestines, invade the tissues, and set up the train of symptoms—usually ending in death—known as louping-ill.

Prevention.—Dip the sheep, remove them to fresh pasture, and give them corn and salt; to every pound of salt add one ounce of sulphate of iron.

Treatment.—Of little use; look to prevention. As a preventive the Committee recommend drenching with cultures of the organism as for braxy.

Blindness.

Sheep are sometimes attacked by temporary blindness, often lasting only about ten days.

Cause.—Changes of temperature; the reflection of the sun on snow; dusty roads on a long journey; and confinement in badly ventilated ships' holds.

Prevention.—Remove the cause.

Treatment.—If left to nature, the blindness will probably pass away. Lambs thus affected require extra care, and should be put to the ewes so that they should not suffer from loss of milk.

Lockjaw or Tetanus.

Symptoms.—Practically the same as those in the case of the horse (p. 440).

Cause.—Cold, especially during lambing-time; also produced by careless castration, wounds, &c.

Prevention.—Shelter and careful attention will do much to avert this disease. (See pp. 440, 441.)

Treatment.—Give castor-oil, 2 oz., repeating the dose every six hours till it takes effect. Give, in gruel, tincture of opium, 1 dr., morning and evening. Fleming's tincture of aconite, 5 drops, may be added to the gruel if there is no relief.

Staggers, Sturdy, Goggles, Fern-sick, Dunt, or Turn-sick.

Symptoms.—Dulness; unsteady walk, generally in a circle; separation from the rest of the flock; blindness. The animal affected will often fall into a ditch and perish, or die gradually. This disease generally attacks young sheep in good condition.

Cause.—A species of parasite—the *Cœnurus cerebralis*—in cysts or bladders containing fluid, which lodge in the brain.

Prevention.—Young sheep in damp situations are very liable to this disease, and care should be taken to avoid putting them into such pastures. The use of lump or rock salt, which they can lick as often as they like, helps to ward off this and similar diseases. Keep your sheep-dog free from tape-worms, for it is the egg of this worm that gets into the brain.

Treatment.—Slaughter is the most profitable course to follow. There is a method of treating this disease by puncturing the soft place in the skull, and removing the bag or cyst; but unless this is done in good time, and performed skilfully, it is rarely successful.

Water on the Brain.

This disease often affects very young lambs.

Symptoms.—Dulness and stupidity; staggering gait; rapid loss of flesh. Death may ensue in about a month.

Cause.—Often congenital, commencing before birth; constitutional weakness.

Treatment.—No cure, so far as the farmer is concerned.

DISEASES AFFECTING THE THROAT, CHEST, RESPIRATORY ORGANS, AND BLOOD.

Catarrh.

Symptoms.—Dulness; loss of appetite; difficulty in swallowing; water running from the eyes and nose; hot mouth and muzzle; constipation; cough, and discharge of yellow mucus from the nose.

Cause.—Chills and exposure.

Treatment.—Give daily, in linseed gruel, nitre, 1 dr.; digitalis, 1 scr., and keep the animal warm.

Hoose or Husk.

Symptoms.—A husky cough, which increases if the animal is hurried. Gradual loss of condition, till the health is undermined. In time the diseased lungs will no longer be able to purify the blood, and the animal will die.

Cause.—The presence of parasites—the *Strongylus filaria*, and sometimes the *Strongylus rufescens* also—in the bronchi and lungs.

Prevention.—Lambs should never be depastured on land fed previously the same year with sheep. If this advice is acted on, and proper care taken of the flock, cases of hoose will be less frequent on most farms.

Treatment.—Give daily: turpentine, 1 dr., for a lamb; 3 drs. for a sheep, in respectively 6 and 12 drs. of sweet-oil, and feed liberally, giving some good linseed-cake with the food. Veterinary surgeons now use injections of parasiticides into the windpipe.

Pneumonia—Inflammation of the Lungs.

Symptoms.—Hard breathing; loss of appetite; fever; cough, which becomes more and more distressing; discharge from the nose; thirst. Afterwards intense weakness sets in, too often followed by unconsciousness and death.

Cause.—Cold, particularly from shearing in cold weather.

Treatment.—Give in linseed-tea, Fleming's tincture of aconite, 5 drops, three times a-day, and with it once a-day tartar of antimony, ½ dr. Keep warm, and in cases of complete prostration,

give, as a stimulant, in the gruel, gin, 1 or 2 oz.

Sheep-pox or Variola ovina.

A contagious and infectious eruptive fever only affecting sheep.

It is scheduled under the Diseases of Animals Acts, but it has not been seen in Britain since 1862.

Cause.—Contagion and infection. In all probability due to an ultra-microscopic organism.

Symptoms.—High fever, loss of appetite, and depression, distinct evidence of serious illness. An eruption of reddish spots appears about the mouth, nose, and eyes, inside the arms and thighs, and about the udder or scrotum. The spots go on to form vesicles and pustules; these usually burst and discharge a yellowish matter, which mats and agglutinates the wool. The animal acquires a sickly disagreeable odour, and becomes a loathsome-like object.

Pregnant ewes often abort.

Prevention.—Sheep should not be admitted into Britain from countries where sheep-pox exists.

DISEASES AFFECTING THE STOMACH, LIVER, BOWELS, KIDNEYS, AND INTERNAL ORGANS, PARTURITION AND MILKING ORGANS.

I.—STOMACH, LIVER, BOWELS, KIDNEYS, AND INTERNAL ORGANS.

Braxy or Sickness.

Symptoms.—Restlessness; hanging of the head; aching of the back; grinding of the teeth; cold extremities; kicking of the belly with the hind feet; distension of the abdomen; separating from the rest of the flock.

Cause.—It is due to an anærobic motile bacillus, very similar to the bacillus of black-quarter. Prevalent in the autumn, especially among the lambs; often runs through a flock like an epizootic.

Prevention.—If possible, keep the sound pastures for the lambs, and avoid letting them have too succulent pasture for grazing, and always let rock-salt be within reach. Do not allow an affected animal to be bled or slaughtered on ground that the rest of the flock have access to, as blood diseases, as well as inflammation of the bowels, enteritis, and acute indigestion, are sometimes all included under the general name of braxy.

Treatment.—Give purgative (No. 34). Fleming's tincture of aconite, 5 drops, may be given in gruel every morning, and the food should be sparing, with a little linseed. The treatment of the disease is generally unsatisfactory. Change their pasture, and if on good arable grass, put them on the heather, if possible, for a day or two. A Departmental Committee, of which Professor Hamilton of Aberdeen was chairman, was appointed by the Board of Agriculture, in December 1901, to investigate braxy and louping-ill. This Committee, in 1906, recommended as a preventive, a drench prepared from cultures of the organism, the bacillus, on glucose beef-tea. A small quantity of this culture to be mixed with water and given by the mouth, the dose to be repeated in from 8 to 14 days.

Calculus or Gall-stones, and Kindred Diseases of the Bladder.

Symptoms.—Dulness; loss of appetite; separation from the flock, generally lying down; quick breathing; when roused, painful efforts to void urine, only a few drops of which come away. Saline deposits will sometimes be found in the sheath.

Cause.—High and stimulating system of feeding, especially on saccharine roots, such as mangel-wurzel; want of exercise; absence of water for drinking.

Prevention.—Avoid an exclusively saccharine and starchy diet, and allow free access to water.

Treatment.—In the latter case warm fomentations and syringing with tepid water may get rid of the deposit; afterwards wash out the sheath with an astringent lotion. But if the seat of the malady cannot be reached, the sheep should be at once slaughtered when the disease is suspected.

Constipation.

Symptoms.—Dulness and costiveness.

Cause.—Especially prevalent among young lambs, caused by the quality or too great quantity of the ewes' milk, which has coagulated in the stomach.

Prevention.—Avoid any irregularity in the ewes' food, and especially too luxuriant pasture.

Treatment.—Put the ewes on shorter pasture, and give every morning as much warm water, with Epsom salts, 1 oz., dissolved in it, as the lamb can take.

Lambs also suffer from *wool balls*, which form in the stomach. There is no cure, but care should be taken that the bags of ewes should be kept as clear of wool as possible, in order to prevent lambs getting it into their stomachs.

Diarrhœa.

Symptoms.—Simple looseness of the bowels without much pain.

Cause.—Fresh, succulent herbage, especially when it has been touched with frost.

Treatment.—Change the pasture or source of irritation, and if weakness comes on, give rhubarb, 1 dr., and afterwards, in warm gruel, powdered opium, 20 grs.; catechu, ½ dr.; prepared chalk, ¼ oz.

Dysentery.

Symptoms.—Frequent evacuations of hard lumps of fœtid dung, mixed with slime and blood; loss of appetite; pain, fever, and great weakness. Affects sheep of any age, generally in the summer.

Cause.—Aggravated and unchecked diarrhœa; chills after being clipped. Many believe it to be contagious.

Prevention.—Sheep that are scouring should be watched, the food altered, and any aggravation of the attack checked.

Treatment.—Give in warm water, three times a-day, ipecacuanha, ½ dr.; powdered opium, 20 grs.; chlorodyne, 10 drops; chalk, ¼ oz. Gruel, or if animal will eat, flour-porridge, sprinkled with salt, should be given.

Hoove, Hove, or Hoven.

A distension of the stomach by gas, owing to the fermentation of food which has been too long retained in it.

Symptoms.—Enlargement of the belly, especially on the left side, which sounds hollow when tapped. Stupor and death follow, unless the animal is relieved.

Cause.—When sheep are incautiously fed on green clover or turnips, they are apt to eat to excess, and fermentation of food in the stomach sets in before the organs are able to dispose of the accumulation of food.

Prevention.—Green clover and turnips should be given in small quantities at first, and sheep should only be turned into a very succulent pasture for an hour or two till they get accustomed to it, when there will be no danger of hoove.

Treatment.—The insertion of a trocar into the flank will relieve the pressure of gas, and a dose of purgative (No. 33) will open the bowels. A drachm of chloride of lime dissolved in a quarter of a pint of water, and horned into the sheep, will often reduce the pressure of gas. The subsequent food should be rather scanty.

Inflammation of the Liver.

Symptoms.—Loss of appetite; skin hard and itchy; tongue foul; dung white and fœtid; weakness.

Cause.—Sudden change from poor to nutritious food is generally the cause.

Prevention.—Extra care when any change of food takes place.

Treatment.—Give daily, in gruel, purgative (No. 32). Foment the body over the liver with hot water, and inject warm water if the bowels are costive. In chronic cases of this disease, salt (4 oz. per head per week) should be given in addition to the purgative above mentioned.

Inflammation of the Stomach.

Symptoms.—Loss of appetite and separation from the flock; alternate hot and cold shivering fits; restlessness; straining to empty the bladder.

Cause.—Too nutritious food, or irritating or poisonous plants.

Prevention.—Avoid exposing the lambs to chills and cold east winds after being cut, and exercise care when forcing on sheep for the market.

Treatment.—Foment the belly; give Fleming's tincture of aconite, 5 drops, twice a-day, and purgative (No. 34), halving the dose in the case of young lambs. Keep warm, and let the food consist of warm gruel with a little boiled linseed in it.

Jaundice.

Symptoms.—Yellowness of the skin and eye; constipation; urine brown; loss of appetite.

Cause. — Richness of the pasture, especially in damp sultry weather.

Prevention.—The use of salt among the artificial food, combined with care as to the nature of the pasture, will make the appearance of this disease rare.

Treatment.—Give purgative (No. 32) and frequent doses of salt, 4 oz. per head per week.

Rot.

Symptoms.—At first the animal will lay on fat very quickly, but afterwards the wool begins to fall off; the eyes become hollow, the belly enlarged; swellings appear on the body; scouring sets in, and finally death ensues.

Cause.—The presence of the *Distoma hepaticum*, or flukes in the liver, especially prevalent in wet seasons. Sheep fed on low-lying, wet, and undrained land are very subject to this disease.

Prevention.—The use of salt in the food and judicious grazing during wet seasons will do much as preventives.

Treatment. — Remove the flock at once to dry uplands or salt-marshes if available, and give salt in the food, 4 oz. per head per week, and as much in the troughs as the sheep will lick up.

II.—PARTURITION AND MILKING ORGANS.

Garget or Inflammation of the Udder.

Symptoms. — Pain when the lambs are sucking, lameness, restlessness, fever, inflammation, and swelling of the udder.

Cause.—Stoppage of the secretion of milk; exposure to cold; injuries.

Prevention.—Care should be taken to prevent the udder being surcharged with milk, especially when the lambs are weaned or dead.

Treatment.—Foment the udder with warm water, and clear it from all wool. If not very painful, let the lamb suck it and knock it about as much as possible. Give purgative (No. 33), and remove all the milk by frequent milkings; rub the udder with belladonna liniment.

Parturient Fever—"Heaving," "Straining."

Symptoms.—Fever, loss of milk, listlessness, frothy saliva, stiffness of the hind quarters, discharge of dark fœtid fluid from the vagina, swelling of the vulva, straining, and pain. The whole constitution will be affected, diarrhœa sets in, followed by death. This disease is nearly always fatal.

Cause.—Probably the result of blood-poisoning, owing to deleterious matter entering the system through wounds of the parturient organs.

Prevention.—Should any wounds be made during parturition, they should be washed with warm water and syringed with lotion (No. 30) daily for some days, and afterwards anointed with glycerine, 8 parts, carbolic acid, 1 part. Great cleanliness should be observed in the lambing-yard, and a free use made of carbolic acid, and the hands washed and nails cut before manipulating the womb.

Treatment.—Besides the injection of carbolic lotion, give every four hours carbolic acid, 20 drops, in water; and if constipated, purgative (No. 33); give plenty of gruel and linseed-tea. If straining and diarrhœa come on, give whisky, 4 oz., and tincture of opium, 1 oz., in gruel. The treatment is, however, generally unsatisfactory.

Abortion,

or the premature expulsion of the fœtus.

Symptoms.—There are no particular symptoms in abortion among ewes.

Cause. — Overdriving; cold; improper food; injuries to, or disease of, the abdomen. A very frequent cause is the disturbance of sheep by dogs.

Prevention and Treatment.—When cases of abortion occur, the cause of the disease must, if possible, be ascertained and removed. It may generally be traced to one of the causes mentioned above. When one sees a flock of ewes occupying a turnip-fold, only vacated by the fat hoggs when it was too bad for them, up to their bellies in mud, one can hardly be surprised that cases of abortion are only too frequent. Given a proper rational system for the management of a breeding flock, and cases of abortion will be rare, and only the result of

circumstances which cannot be altogether avoided. Should a ewe appear sickly after abortion, inject lotion composed of carbolic acid, 1 part; water, 40 parts; and give purgative (No. 33).

DISEASES AFFECTING THE LIMBS, FEET, AND SKIN.

Foot-rot.

Symptoms.—Lameness, which may be traced to disease between the claws of the feet, indicated by the discharge of matter and swelling, which, if not checked, will gradually extend to the whole of the foot. Or the horn of the hoof may be broken or fissured, and often a fœtid discharge. In old cases the horn is rough, enlarged, and deformed, and fungoid granulations may project from any openings in the horn, and from sores about the coronet.

Cause.—Often contagion, grazing on low, rich pastures, encouraging overgrowth of the hoofs, which are apt to split and crack and collect dirt.

Prevention.—The maxim, "A stitch in time," &c., if put into practice, will prevent the disease spreading, and will soon cure those affected. As a means of prevention it is useful to pass the whole flock twice a-year through a solution of arsenic, put into a trough, through which the sheep are driven slowly. The solution is thus prepared: Boil 2 lb. of arsenic with 2 lb. of potash (pearl-ash) in 1 gallon of water over a slow fire for half an hour; keep stirring, and when like to boil over, pour in a little cold water; then add 5 gallons of cold water. Put this solution into the trough to the depth of 1¼ inch. The solution is poisonous, so the trough should be kept locked when not in use. A bath of copper sulphate is perhaps as useful and less dangerous. Dissolve 1 lb. of sulphate of copper in 2 gallons of water, and walk the sheep slowly through it as often as required.

Treatment.—Pare away all loose ragged horn, to allow the matter to discharge, cut away any proud flesh with sharp scissors, and have recourse to a stronger bath of copper sulphate—1 lb. to 1 gallon of water; and in bad cases it may have to be used every four to seven days. A narrow trough about 7 inches wide, sloping a little outwards, with rails on each side 16 to 18 inches wide, or sufficiently wide to admit the bodies of the sheep, and from 15 to 20 feet long.

As copper is poisonous, although not nearly so bad as arsenic, the sheep should be put in a bare court, or on to a hard road until the feet become dry.

Note.—Sheep, when they have travelled far on hard stony roads, get very footsore, and, if possible, should be put on soft cool pasture for a few days, when the feet will soon recover.

Rickets—Weak Backs.

Lameness of hind quarters, resulting from weakness of bones, which, from their constitution, are liable to injury under trifling exertion. This disease only affects the lambs, and when once it appears may run right through the flock. The outbreak may occur at any time while the lambs are young.

Symptoms.—Difficulty in rising; the fore feet are not affected.

Cause.—Peculiar condition of the soil, pointing to an insufficiency of particular elements necessary to produce a perfect offspring. Food grown on light moor tillage land, dressed with caustic lime, is believed by some to produce rickets.

Prevention.—Avoid in-and-in breeding, and also food grown on land which, as above described, is apt to produce the affection.

Treatment.—Direct treatment is useless.

Sheep-Scab, Shab, or Mange.

An eruption of the skin, produced by parasites—the *Dematodectes ovis*—minute acari which burrow in the skin.

Symptoms.—Constant rubbing against gates, &c.; loss of wool; skin red, rough, and afterwards covered with hard scabs; loss of health and condition.

Cause.—Contagion.

This affection is scheduled under the Diseases of Animals Acts, and the treatment is prescribed by the Board of Agriculture. Affected sheep must be dipped in a "dip" approved by the Board, and the owner cannot be com-

pelled to dip them a second time under 10 days.

At the present time (1909) the Board demands that within certain districts of country, which it terms "compulsory dipping areas," all sheep shall be dipped, in an approved dip, twice a-year, within certain specified dates.

Vermin.

Sheep ticks and lice may be destroyed by the use of one of the many dips which are sold for the purpose.

Maggots may be destroyed by applying spirit of tar, 1 part, olive-oil, 4 parts, to the places affected. It will also keep off the flies.

SWINE.

Anthrax.—(See p. 468.)

Symptoms. — Dulness; urine, and sometimes the dung, mixed with blood, external swellings. When caused by eating the flesh or blood of animals dying of the disease, there is nearly always great swelling about the throat.

Cause.—Generally contagion.

Prevention.—Keep in good condition, and avoid close buildings, putrid food, and bad water. Completely isolate all diseased animals.

Treatment.—Owing to the rapid and fatal nature of this disease, all treatment is unsatisfactory. But it is not so fatal as in horses and cattle, although young pigs are more easily affected by it than grown ones. Give Epsom salts, 3 oz., and oil of turpentine, 2 drs., in a little linseed-gruel, and rub the limbs with oil of turpentine. Call in a veterinary surgeon, who will inject diluted carbolic acid under the skin.

Convulsions.

Symptoms.—Young pigs are subject to convulsions, which take the form of sudden spasms with complete insensibility, frothing from the mouth, and redness of the eyeballs.

Cause.—Disorders of the brain; indigestion; sometimes intestinal worms.

Prevention.—Good water and nourishing food.

Treatment. — Give a purgative — Epsom salts — regulating the dose according to size. Remove as far as possible the cause of the attack—*i.e.*, expel the worms if they exist (see p. 492), or alter the food if it has produced indigestion. Give sulphate of iron, 1 dr., in the food.

Diarrhœa.

Symptoms.—Looseness of the bowels, which affects the health. If unaccompanied by loss of appetite, fever, or prostration, no treatment is required beyond removing the cause.

Cause.—Often a symptom of some other disease. Often caused by indigestion, putrid food or water.

Prevention.—Proper food and attention.

Treatment. — Give castor-oil, 3 oz., and peppermint-oil, 5 drops, in gruel.

Erysipelas.

Symptoms.—Heat; itching; redness; tenderness and swelling of the skin, generally on the head and neck; loss of appetite. When the swelling goes down at the end of a few days, a dark-red patch will be left.

Cause. — Want of ventilation; dirt; heating food; wounds.

Treatment.—Give, in gruel, jalap, 1 dr.; sulphate of magnesia, 3 oz., mixed in a little water, and as soon as the purgative has acted, give muriate of iron, 10 drops, night and morning, in food. Foment the swellings on the skin with water, 1 quart, in which 1 oz. of sulphate of zinc has been previously dissolved. Good nourishing food should be given, and the animal should be completely isolated.

Hoose or Husk (see p. 471).

Symptoms.—Short, dry cough; frothy discharge from the nose; loss of appetite; thirst; loss of flesh, till finally death results.

Cause. — The presence of worms in the air-passages, amounting almost to an epizootic in certain districts.

Prevention.—Keep in good condition, and isolate from infected animals; pure water, and clean or boiled food.

Treatment. — Give, in milk, salt, 1 teaspoonful (1 dr.); oil of turpentine, 1 teaspoonful, daily. Fumigate in a close building by burning flowers of sulphur on a hot shovel till the animals can bear

no more without coughing violently, and repeat the fumigation every week. Give linseed-porridge, nourishing food, and plenty of skim-milk.

Pneumonia—Inflammation of the Lungs.

Symptoms. — Shivering; hot skin; laboured breathing; red eyes, nose, and mouth; cough deep and dry; yellow discharge from the nose.

Cause.—Cold, aggravated by neglect and predisposition to the disease; may result from hoose.

Prevention. — Nourishing food, and warm dry bedding.

Treatment.—Cover with a warm rug, but allow plenty of cool fresh air; rub the chest with mustard, 1 part, and turpentine, 4 parts, and repeat the rubbing. Give spirits of nitrous ether, 2 drs.; tincture of opium, 2 drs., in a little milk twice a-day, and put 2 drs. of nitrate of potash in its food every time the animal is fed.

Measles.

Symptoms. — Fever; cough; loss of appetite; red patches on the skin; pustules under the tongue.

Treatment. — Give, fasting, 1 oz. of sulphur in the food, and repeat the dose till the animal is quite recovered. Keep the animals warm.

Prolapse of the Rectum.

After parturition, and even in young pigs of both sexes, the rectum sometimes protrudes and swells.

Treatment. — The gut should be emptied and washed. It may be returned by inserting the finger into the opening and pressing it into the anus. A nourishing diet should be given. Sometimes a truss will be necessary to keep the gut in its place after it has been returned. It may be necessary to amputate the protruding part. Advice should be obtained if this is found to be necessary.

Rheumatism, Cramp, Lameness.

Symptoms. — Dulness; lameness, especially of the hind quarters; tenderness of the joints; constipation.

Cause. — Damp bedding; lying on cold brick floors; chills. Especially prevalent where pigs lie on fermenting horse-manure.

Prevention. — Allow young pigs plenty of exercise and dry bedding in which they may bury themselves.

Treatment.—Give Epsom salts, 1 oz., and sulphur, 1 oz., in thin gruel, salicylate of soda, 1 dr., and bicarbonate of soda, 2 to 4 drs., twice a-day. Keep warm, and feed on nutritious food of good quality.

Surfeit.

Symptoms. — Fever; swellings in patches on the lips, eyelids, and nostrils, which quickly appear and disappear.

Cause.—Change of food or weather. Generally occurs in the autumn.

Treatment.—Give in gruel, jalap, 1 dr.; Epsom salts, 1 oz., and avoid improper feeding.

Swine-fever or Hog-cholera.

A contagious and infectious disease of pigs which has been known in Britain and America since about the middle of last century, and has often caused very severe losses. Notwithstanding, it was not dealt with in the Contagious Diseases (Animals) Act of 1878, but was included by "The Animals Order," dated 15th December 1879, as was also glanders and farcy. And although the Privy Council and, since its institution, the Board of Agriculture have passed innumerable Orders and struggled at the suppression of the disease, it is still only too prevalent in the country.

Cause.—Two organisms seem to be always present, probably associated, in swine-fever—a small ovoid bacillus, the *Bacillus cholerœ suis*, and an invisible infective organism.

Symptoms. — It is sometimes very acute, especially in young pigs. They become suddenly ill, there is high fever, quickened breathing, a rash appears over the thinnest parts of the skin—on the back of the ears and about the belly—they stagger about, and often die in convulsions. Generally it is less rapid, the animal is dull, does not care to come out of its pen, but lies buried under its litter. There is loss of appetite, constipation at first, generally followed by diarrhœa, fever, the eyes look red and watery, the tail hangs limp, red blotches

appear about the back of the ears, inside the arms and thighs, and about the belly. These gradually become darker until they may be dark-purple or almost black. The lungs are frequently affected, causing rapid breathing and a short painful cough. Animals often die after two or three days' illness, but they may die after a fortnight, and one will sometimes recover after being very ill, but takes a long time to make a complete recovery. It is doubtful also how long an animal that has been very ill with swine-fever may prove a centre of infection—several months at least.

Treatment. — As it is the digestive tract that is principally affected, only the blandest and least irritating foods should be allowed — skimmed milk, alone or with lime-water, fine well-boiled gruels, beef-tea, which if well boiled can be made from meat which would otherwise be destroyed, and anything which will support the strength without causing irritation. Some also recommend mild antiseptics given internally.

Prevention.—A protective serum has been introduced and can be applied by any veterinary surgeon; but few would care to use it unless the disease has broken out in their immediate neighbourhood or in a large valuable breeding herd.

Isolation and Police Measures.— Any person having a diseased or suspected pig in his possession must at once give notice to the police, and they telegraph the information to the Board of Agriculture, who then deal with the case. An "infected place" is declared, and all movement of pigs out of or into it is stopped except with the licence of the Board. The movement of pigs on any premises in the vicinity is also generally stopped as long as it is thought there is any risk.

The policy adopted in dealing with swine-fever has undergone many changes during the past thirty years, and in 1908 a reversion was made to a system more nearly approaching the stamping out method than has been in use for some time. While the Board retains perfect liberty to deal with separate outbreaks as it considers best, as a rule it now takes over the young and immature pigs and the breeding swine and has them destroyed, paying full value for healthy pigs and half value for diseased ones, on the understanding that the owner will, as rapidly as possible, have the others killed for the market, and the place cleaned and thoroughly disinfected before any fresh pigs are brought on to it.

As the disease is exceedingly contagious, very strict regulations are laid down by the Board regarding cleansing and disinfection.

Apart from the existence of swine-fever in any place, the Board has divided the whole country into limited districts, which it calls "scheduled areas," presumably to give it some control over the movement of pigs, and pigs cannot be moved from one to another without a licence.

Other Contagious Diseases of Pigs.

There are other two diseases of pigs known to be contagious, one of which—swine erysipelas — is not uncommon in Britain. It sometimes causes considerable losses, and in these cases is generally believed by pig-owners to be swine-fever, but is not nearly so fatal nor so contagious in this country as the latter, and has not been scheduled by the Board.

The other contagious disease of pigs is swine plague, sometimes very destructive on the Continent. It is doubtful if it has ever appeared in Britain. At least, if it has it has not done much harm.

Worms (Intestinal).

Symptoms. — Ill-health; scurfy, dry skin; irregular appetite; itchiness of the anus, and the passing of worms; loss of flesh; cough; scour.

Prevention.—Sound food and water.

Treatment.—Give santonine, 3 grs., on an empty stomach, and four days later repeat the dose; the next day give 3 oz. Epsom salts. Allow access to plenty of coal, slack, or cinders, so that the pigs may eat as much grit as they like.

Trichinosis.

A parasitic disease of the pig, but rarely seen in this country.

Symptoms.—The animal is dull, loss of appetite, goes stiffly, vomits frequent-

ly. As the disease advances, the animal persistently stands, and when it lies down it tries to bury itself under the bedding.

Cause.—It is due to a minute worm called the *Trichina spiralis*, which infests the whole body; far more common in Germany and America than in this country.

Treatment.—Slaughter and bury the animals at once, for the diseased pork is poisonous to human beings.

Lice.

These may be easily removed by washing with water saturated with petroleum.

DOGS.

Rabies or Hydrophobia.

The only disease with which dogs are specially liable to be affected that need be noticed here is that dreaded disease, rabies, hydrophobia, or madness, as it is variously called. No disease of animals is more dreaded by man than canine madness, and the cry "mad dog" runs through a district like the sound of an alarm-gun. Scheduled under the Diseases of Animals Acts, it has been stamped out in Britain by the vigorous action of the Board of Agriculture, but there is always a risk of its re-introduction.

Cause.—It is not contagious in the ordinary sense, but is an inoculable disease, doubtless due to some living contagious agent which has not yet been clearly demonstrated. It is inoculable to all animals, including man, its natural mode of communication being by the bites of rabid dogs, and it is never seen in our larger animals but from this cause.

Symptoms.—There is some change in the habits of the dog. He may hide away in a dark corner, or creep under a bed or couch. Will often pick up and swallow pieces of string, rags, leather, straw, feathers, or pieces of wood. He becomes restless, generally wanders from home, and hurries along at a slouching trot, saliva flowing from his mouth, and there may be froth. He will snap at animals or persons who may come in his way, has no fear, and will bite at any object held out to him. The voice is altered, and becomes something between a bark and a howl. Later, paralysis sets in, the jaw droops, and death soon follows. In the larger animals there is generally excitement, often excitement of the genital organs. The horse may get perfectly delirious,—would bite, kick, and smash everything within his reach. The ox will even try to bite, and will butt at anything and everything.

Treatment.—Immediate slaughter as soon as definite symptoms are present.

Prevention.—Keep it out of the country; rigorous police measures.

Persons bitten by rabid animals are subjected to a system of inoculation.

RECIPES.

The scientific names are given as found in the *British Pharmacopœia* and *Squire's Companion to the British Pharmacopœia*. Directions for preparing the mixtures are appended to each recipe.

ABBREVIATIONS.

Grains, grs.; scruple, scr.: drachms, drs.; Pounds, lb.; ounces, oz.; quart, qt.; pint, pt.

HORSES.

BLISTERS.

1. Powdered cantharides (*P. cantharis*), 1 oz.
   Olive-oil (*Oleum olivæ*), 8 oz.
   Use the ordinary "salad-oil" obtainable from grocers. Mix together in an earthenware pot, and infuse in a water-bath for four hours, and strain. Clip hair off the part before application.

2. Powdered cantharides (*Cantharis*), ¼ lb.
   Lard (*Adeps præparatus*), 1 lb.
   Resin (*Resina*), ¼ lb.
   Melt the resin and lard together at a low temperature, then sprinkle in the cantharides, and stir till cold.

3. Perchloride of mercury (corrosive sublimate) (*Hydrargyri perchloridum*), 40 grs.
   Methylated spirit (*Spent methyll*), 1 oz.
   To be applied with a small brush. Shake together in a bottle until dissolved.

4. Red iodide of mercury (*Hydrargyri iodidum rubrum*), ½ lb.
   Lard (*Adeps præparatus*), 4 lb.
   Mix together. Poison.

5. Iodine (*Iodum*), 2 oz.
   Iodide of potassium (*Potassii iodidum*), 1 oz.
   Camphor (*Camphora*), ½ oz.
   Methylated spirit, 1 pt.

Should be made up by a qualified party. Put the iodine and iodide of potassium in a bottle with 15 oz. of the spirit, shake till dissolved. Dissolve the camphor in 5 oz., then mix together.

CONDITION POWDERS.

6. Fenugrek, 2 parts.
Carbonate of iron, 1 part.
Nitrate of potassium (*Potassii nitras*), 2 parts.
Gentian powder (*Gentianæ radix*), 1 part.
Sulphur (*Sulphur sublimatum*), 2 parts.
Mix all together and sift. Give 1 oz. daily in the food.

COOLING LOTION.

7. Solution of subacetate of lead (*Liquor plumbi subacetatii*), 1 part.
Tincture of arnica (*Tinctura arnicæ*), 3 parts.
Water (*Aqua*), 8 parts.
Mix.

COUGH BALL.

8. Digitalis (*Digitales folia*), ½ dr.
Powdered opium (*Opium*), 1 dr.
Aloes (*Aloe barbadensis*), 1 dr.
Soft-soap (*Sapo mollis*) } enough to
Linseed-meal (*Lini farina*) } make a ball.
Make into a stiff mass. Give one ball every day.

DRAUGHTS.

9. Spirits of ammonia (*Spiritus ammoniæ aromaticus*), 1½ oz.
Chloroform (*Chloroformum methyll*), 1 oz.
Bicarbonate of potash (*Potassii bicarbonas*), ½ oz.
Water (*Aqua*), 10 oz.
Mix. Shake up well before giving in gruel or other bland liquid. Every two hours till improvement, then twice a-day.

FOR BRONCHITIS.

10. Tincture of digitalis (*Tinctura digitalis*), 3 drs.
Bromide of potassium (*Potassii bromidum*), 2 drs.
Nitrous ether SPIRIT (*Ætheris nitrosi*), 1 oz.
Water (*Aqua*), 10 oz.
Dissolve bromide of potassium in water, add the other ingredients, and make up with water to 10 oz. To be given three times a-day.

FOR WORMS.

11. Extract male fern (*Extractum filicis liquidum*), 2 drs.
Oil of turpentine (*Oleum terebinthinæ*), 1½ oz.
Linseed-oil (*Oleum lini*), 1 pt.
Mix and shake well together.

EMBROCATION.

12. Hartshorn (*Liq. ammon. dil.*), 1 oz.
Turpentine (*Oleum terebinthinæ*), 2 oz.
Spirit of camphor (*Spiritus camphoræ*), 2 oz.
Laudanum (*Tinctura opii*), ½ oz.
Olive-oil (*Oleum olivæ*), 6 oz.
Mix the hartshorn with the olive-oil, and shake, then the turpentine, spirit of camphor, and laudanum, shaking after each addition. Shake well before using.

CLYSTER.

13. Oatmeal, 3 qts.
Salt, 3 oz.
Olive-oil, ½ pint.
Give warm, and repeat till relief is given.

IRRITANT.

14. Ammonia solution (*Liquor ammoniæ*, F.), 3 oz.
Soft-soap (*Sapo mollis*), 4 oz.
Oil of turpentine (*Oleum terebinthinæ*), 8 oz.
Olive-oil (*Oleum olivæ*), 4 oz.
Rub the soap with the olive-oil to smoothness, then add turpentine and ammonia solution. Bottle, and shake well.

LINIMENT.

15. Mustard (*Sinapis*), 4 oz.
Oil of turpentine (*Oleum terebinthinæ*), 5 oz.
Linseed-oil (*Oleum lini*), 1 pt.
Mix together, and shake thoroughly.

LOTION.

16. Tincture of myrrh (*Tinctura myrrhæ*), 1 oz.
Alum (*Alumen*), 2 drs.
Water (*Aqua*), 6 oz.
Mix together.

PURGATIVES.

17. Aloes powdered (*Aloe barbadensis*), 6 drs.
Ginger (*Zingiber*) 2 drs.
Made into a ball with soap or treacle.

18. Calomel (*Hydrargyri subchloridum*), 1 dr.
Opium, powdered (*Opium*), 20 grs.
To be made into a ball with linseed-meal and treacle.

19. Aloes (*Aloe barbadensis*), 1½ dr.
Tartar emetic (*Antimonium tartaratum*), 1 dr.
Nitre (*Potassii nitras*), 2 drs.
Digitalis (*Digitales folia*), ½ dr.
To be made into a ball with meal and treacle.

ORDINARY PURGATIVE.

20. Barbadoes aloes (*Aloe barbadensis*), 1½ dr.
Calomel (*Hydrargyri subchloridum*), 1 dr.
To be made into a ball with meal and treacle.

TONIC.

21 Sulphate of iron (*Ferri sulph.*), 1½ dr.
Sulphate of quinine (*Quininæ sulph.*), 20 grs.
Sulphuric acid, diluted (*Acidum sulphuricum dilutum*), 2 drs.
Water (*Aqua*), 10 oz.
Dissolve the sulphate of iron in water, diffuse quinine in the solution, then add diluted sulphuric acid, and make up to 10 oz.
Give morning and night.

CATTLE.

BLISTER

22. Powdered cantharides (*Cantharis*), 1 oz.
Olive-oil (*Oleum olivæ*), 8 oz.
Use the ordinary "salad-oil" obtainable from grocers. Mix together in an earthenware pot, and infuse in a water-bath for four hours, and strain. Clip hair off the part before application.

23. Powdered cantharides, 1 part.
Venice turpentine, 1 part.
Resin, 1 part.
Lard, 4 parts.
Melt resin and lard together, then stir in the cantharides and Venice turpentine.

CALF-CORDIAL.

24. Prepared chalk (*Creta præparata*), 2 oz.
Powdered catechu (*Catechu*), 1 oz.
Ginger (*Zingiber*), ½ oz.
Opium (*Opium*), 2 drs.
Peppermint-water (*Aquæ menthæ peperitæ*), 1 pt.
Dose for calf, two tablespoonfuls morning and evening; dose for sheep, one tablespoonful morning and evening.
Mix all together.

DRAUGHT FOR COUGHS, &c.

25. Powdered digitalis (*Digitales foliæ*), 1 dr.
Liquor ammonia acetatis (*Liquor ammonii acetatis*), 3 oz.
Spirits of nitrous ether (*Spiritus ætheris nitrosi*), 2 oz.
Extract belladonna (*Extractum belladonnæ*), 2 drs.
To be given in a pint of water.
Melt extract of belladonna in a little warm water; when cold, add the other ingredients. Shake, and make up to a pint with cold water.

LINIMENT.

26. Oil of turpentine (*Oleum terebinthinæ*), 8 oz.
Solution of ammonia (*Liquor ammoniæ*, F.), 3 oz.
Soft-soap (*Sapo mollis*), 4 oz.
Rub down the soft-soap in the turpentine, then add the ammonia, and shake.

PURGATIVES.

27. Epsom salts (*Magnesii sulphas*), 16 oz.
Powdered aloes (*Aloe barbadensis*), 8 drs.
Ginger (ground) (*Zingiber*), 1 oz.
To be given in a quart of warm water or gruel.
Epsom salts for cattle costs 1s. a stone. Use Barbadoes aloes and ordinary domestic ginger.

MILD PURGATIVE.

28. Epsom salts (*Magnesii sulphas*), 12 oz.
Powdered ginger (*Zingiber*), ½ oz.
To be given in a quart of warm water or gruel.
Salts for cattle, and ordinary ginger.

TONIC.

29. Gentian (*Gentianæ radix*), 1 oz.
Ginger (*Zingiber*), ½ oz.
Carbonate of ammonia (*Ammonii carbonas*), ½ oz.
Carbonate of iron, 2 drs.
To be given in a pint of gruel or water

SHEEP.

LOTION.

30. Carbolic acid (*Acidum carbolicum*), 1 part.
Water (*Aqua*), 50 parts.
Shake.

DRESSING FOR FOOT-ROT.

31. Red nitrate of mercury (*Hydrargyri oxidum rubrum*), 1 oz.
Nitrous acid, 2 oz.
To be mixed with two tablespoonfuls of water; dissolve the red nitrate of mercury in the acid, and then add the water.

PURGATIVES.

32. Calomel (*Hydrargyri subchloridum*), 5 grs.
Powdered opium (*Opium*), 4 grs.
Epsom salts (*Magnesii sulphas*), 1 oz.
To be given in 3 oz. of gruel or water.
All obtainable from a druggist. Mix and give in gruel. Ask for Epsom salts for cattle.

33. Epsom salts (*Magnesii sulphas*), 3 oz.
Ginger (ground) (*Zingiber*), 1 dr.
In thin gruel.
Take ginger used for domestic purposes, mix with the salts, and give in thin gruel.

34. Castor-oil (*Oleum ricini*), 2 oz.
Tincture of opium (laudanum) (*Tinctura opii*), 2 drs.
Use ordinary castor-oil and laudanum; mix, and give.

Note.—The doses given, except where otherwise stated, are intended for fair-grown animals of medium size. Allowance must therefore be made should the age or size of the animal to be treated exceed or otherwise the average.

TABLE OF DOSES.

Horse.	Cattle.	Sheep.	Swine.	Doses.
4 years and over .	2 years .	1 year .	1 year .	1 part.
2 to 3 years . . .	1 " .	6 months	6 months	$\frac{2}{3}$ "
1 year	6 months	3 " .	3 " .	$\frac{1}{2}$ to $\frac{1}{3}$ part.
2 to 10 months. .	1 " .	1 " .	1 " .	$\frac{1}{10}$ to $\frac{1}{10}$ part.

APPENDIX.

ADMINISTERING MEDICINE.

Some notes will be useful as to the methods of administering medicine to the various animals.

The Horse.

Medicine is usually given by the mouth, but sometimes injected under the skin into the blood, by the rectum, and by inhalation.

A drench should never exceed a quart, and before giving it, make sure that it is neither too hot nor too strong, for choking will follow.

A tin bottle is the best for drenching with; if this cannot be had, use a champagne-bottle.

How to fix the animal. — Put on a head-stall or halter; take a piece of rope or plough-line, make a loop at one end, pass the loop first through the nose-band of the halter or head-stall as the case may be, then into the mouth, throw the other end over one of the rafters above, and pull the horse's head up; the medicine should be slowly poured into his mouth, for horses are slow swallowers. Never be guilty of pouring it down the horse's nose, as I have seen some men do, and kill the animal. If the animal makes an attempt to cough whilst you are drenching him, let his head down instantly.

The Ball.—They should never exceed 1½ oz. in weight, and never be given when they have become hard. The best way to give a ball is by the hand, and with a little practice it can be soon learned. Take the tongue gently in the left hand, and draw it to the side of the mouth, place the ball between the fingers of the right hand, quickly run the hand along the roof of the mouth, and leave the ball at the back of the tongue; withdraw the hand, and let go the tongue. The animal will soon swallow, and you will see the ball pass down the left side of the neck. If you are not clever enough to give it in the manner described, use a balling gun or iron. Do not attempt to give a ball on the end of a pointed stick, for you are sure to run the stick into some vital part of the throat, and perhaps ruin the animal.

Cattle.

The cow is best drenched with a bottle or horn, and the quantity should not exceed 2 qts. In giving the medicine, stand on the right side of the cow, seize the nose with the thumb and finger of the left hand, and get some one to hold the horns on the left side. A cow swallows much more quickly than the horse, so it takes but a minute or two to give a drench.

Sheep.

A long-necked sauce-bottle is best to use for sheep. The quantity to be given should not exceed 4 oz. Stand on the right side, span the nose with your finger and thumb, place the finger in the mouth, and slowly run the medicine in at the right side of the mouth.

Swine.

The quantity to be given should not exceed 5 oz. In giving physic to a pig, take a child's old boot, cut a hole in the toe of it about the size of a shilling, place the toe of the boot into the pig's mouth, pour the medicine into the leg portion of the boot, and the pig will bite savagely at the boot and swallow the medicine at the same time.

FOMENTATION.

Fomentation is of great value in all cases of pain and inflammation. Never start to foment a part, however, without having plenty of hot water and time, for it does little or no good unless continued for an hour or two.

In cases of external injuries or inflammation—if it is on the knee or below it—place the leg in a tub full of hot water, if elsewhere soak a piece of flannel or sponge in hot water, and hold on the part.

For internal inflammation, such as in the bowels and the chest, double a blanket, soak it in hot water, and have it held against the chest or belly as the case may be, by a man on each side of the animal, and place over it a waterproof carriage-rug to keep in the heat. The blanket must be dipped into the hot water every three or four minutes. If the blanket is too hot for your hand it is too hot for the horse's skin, so be careful not to scald the animal.

ENEMAS.

Enemas or injections are of various kinds, and are given in cases of constipation to hasten the action of the bowels; in dysentery and diarrhœa to check the action of the bowels; in debility to support the animal, and when in pain to relieve it.

An enema for constipation should consist of linseed-oil, 1 pint; salt, 4 oz.; and warm water, 1 gallon, to be repeated, if required, every four hours.

For diarrhœa and dysentery use *liquor opii sedativus*, 2 oz.; starch, 4 oz.; and warm water, 3 pints. For weakness and debility use half a gallon of warm milk with two eggs, or the same quantity of beef-tea to be given every four or six hours.

To relieve pain use warm water, 1 quart; extract of belladonna, 1 drachm; or *liquor opii sedativus*, 1 oz.; to be given every three hours.

An enema is given by the enema-syringe, and the tail should be depressed for a few minutes after it is given.

BACK-RACKING.

This is occasionally done to remove the hard dung from the bowels, but it is not necessary if an enema has been given. The person who performs this operation should have a small hand, cut the nails short, and oil the hand before introducing it.

POULTICES.

Poultices are applied to certain parts to relieve pain, soften, and draw out any matter that may exist. The poultice should be made of boiled turnips or bran, the softer and warmer the better. A poultice to do any good must be of considerable size, kept on from twelve to twenty-four hours, with hot water continually poured over it, taking care not to scald the animal.

For the foot the poultice should be placed in a stout bag, and fixed around the fetlock by a strap.

CASTRATION.

The horse is usually operated upon at the age of one or two years; but he is sometimes allowed to go uncut until three years old to see if he is worth keeping for an entire horse, or to allow his neck to get developed. The spring or autumn is the best time to perform this operation, as we then avoid the cold winds of winter, and the sultry weather and the troublesome flies of summer.

There are various ways of performing this operation, but the best and most successful way is either by torsion or the hot iron. Some precautions should be taken before operating. Handle the colt for several weeks before, so that when he comes to be cast he will not fight, struggle, and break out into a sweat; feed him sparingly the day before the operation; make sure that both testicles are down and no rupture exists; always see that the ground is soft and free from stones where you intend to cast the animal.

Having haltered the colt, take him to the chosen spot, pass his head through the loop in the rope, pass the two ends between his fore and hind legs, bringing

them back, pass them through the loop at the shoulders, and draw tight until the animal is on his side; then tighten up, wind the rope round the fetlock, include the fore legs, and get a man on each side to hold the end of the rope so as to keep the animal on his back.

To remove the stones by torsion, make a bold cut through the bag, release the stone, place the clams around the cord, put the torsion forceps on the cord about half an inch from the clams, and twist the forceps slowly around until you sever the cord; the other stone to be treated in the same way.

To operate with the hot iron: Having placed the stone in the clams, take a red-hot iron and saw the cord slowly through close to the clams.

Horses are now often operated on standing, the testicles being removed by the ecraseur or clams.

As to after-treatment, house the animal for a few days, and then let it run out during the day, housing it again at night.

From castration, lockjaw, bleeding, inflammation of the bowels, or broken back sometimes arise.

If the animal has only one stone down, postpone the operation, for it is almost certain to come down in a few months; if it never appears, the animal is most likely a "rig," and must be operated on as such.

Calves.

When a few weeks old they can be cut standing, by twisting the tail around one hind leg. Stand behind the calf, cut through the bag, twist the stone several times and scrape the cord closely through with your finger-nails or a blunt knife. When they are several months old they require to be cast. This is done by tying the hind legs together with a rope, place a halter round the neck, take the shank end of the halter and run it through the rope that joins the hind legs, tying it back, pass it through the portion that is around the neck, and draw the legs tight, and fasten. The fore legs can be held by a man. Take the stones off with the hot iron as in the case of the horse.

The bull is best castrated standing with the hot iron.

Pigs.

Let a man seize the pig by its hind legs and hold it between his legs. Cut through the bag, twist the stone several times, and scrape through the cord with a blunt knife or your finger-nails.

Lambs.

Let some one hold them on a bench for you; cut the tip of the bag off, and use the hot iron and clams, or do them the same way as the pig. In many parts, one person takes the lamb in his arms, holding its four legs tightly, two in each hand, while the shepherd cuts the top off the bag with a sharp knife, presses out the stones with his fingers, and draws them away with his teeth, then using the hot iron.

SPAYING.

Heifers and sows are sometimes spayed in order that they may fatten more quickly, but a description of this operation would not enable one to do it, and it can be learned only by watching those skilled in it.

DOCKING.

It is best performed when the animal is but a few months old, and at that age the tail can be easily cut off with a stout pocket-knife, and the end seared with the poker. In adults the operation is as simple, but often followed by excess of bleeding, lockjaw, or an abscess at the end of tail. Having parted the hair at the spot where the tail is to be cut off, tie the top hair back, get some one to hold the tail out, and with a sharp stroke of the docking-machine it is divided. Afterwards, hold the tail up, slightly sear it with the searing-iron, then place a piece of tow saturated in perchloride of iron on the end, bring the hair over it, and tightly tie below.

SETONING.

Setons are tapes passed through certain parts of the body, with the object of either draining an abscess, acting as a counter-irritant, or for the purpose of inoculation.

In using a seton for draining an abscess, such as pole-evil or fistulous withers, always bring it out at the lowest part of the abscess, so as to secure drainage.

In using setons as counter-irritants in cases of lameness, diseases of the eye or brain, pass them simply underneath the skin, and be careful not to wound any internal structure.

For inoculation, in cases of black-quarter or pleuro-pneumonia, the seton must be soaked with some irritant, such as embrocation (No. 12) in the case of black-leg, but in pleuro-pneumonia with the serum of a diseased lung.

NURSING THE SICK.

All the doctoring in the world is of no avail unless associated with good nursing.

Sick horses should be placed in a comfortable loose-box, free from draughts, and with plenty of straw in it. In cold weather a rug should be placed on the animal, and its legs bandaged. Animals, like human beings, soon lose their appetite when sick, so that every means should be tried to induce them to feed. The diet must be soft, nourishing, and given frequently in small quantities.

The following foods are recommended: bran-mashes, with bruised oats, sweet hay with a little treacle-water sprinkled over it, scalded oats, a little linseed-cake, and, when in season, grass, tares, carrots, and parsnips can be given sparingly if the horse is not suffering from any bowel affection. A pail of oaten or linseed gruel should be placed within the reach of the animal, and if it does not drink this, give it treacle-and-water, or water with a tablespoonful of nitre dissolved in it. Take the chill off the water if the weather is cold.

Never allow one kind of food to remain too long in front of the animal; take it out and try something fresh. The animal should, if strong enough, and the weather permits, be taken out every day, and led up and down for half an hour with a rug on. Exercise of this kind strengthens the animal and increases the appetite. See that the manger and bucket from which the horse is fed are clean, for horses are naturally very sensitive as to what they eat, and more so when they are sick. Sick horses should every morning get a thorough wisping down.

Do not work the animal before it has properly recovered, and then gradually.

A USEFUL TABLE.

It is useful for stock-owners to have before them the following table, indicating a normal condition of the pulse, respiration, and temperature of their various animals; also the period of gestation.

	Pulse.		Respiration—Beats per Minute.	Temperature—Degrees Fahrenheit.	Average Duration of Pregnancy.
	Beats per Minute.	Where felt.			
Horse . .	40	Jaw . . .	10	100	48 weeks.
Cow . . .	45	Jaw . . .	12	101.5	40 "
Sheep . .	75	At the heart.	18	102.5	21 "
Pig . . .	60	At the heart.	15	102.5	16 "
Dog . . .	100	Thigh . . .	20	102	9 "

PLATE 9

CLYDESDALE STALLION, "HIAWATHA," 10,067.

THE PROPERTY OF JOHN POLLOCK, ESQ., PAPER MILL, LANGSIDE, RENFREW.

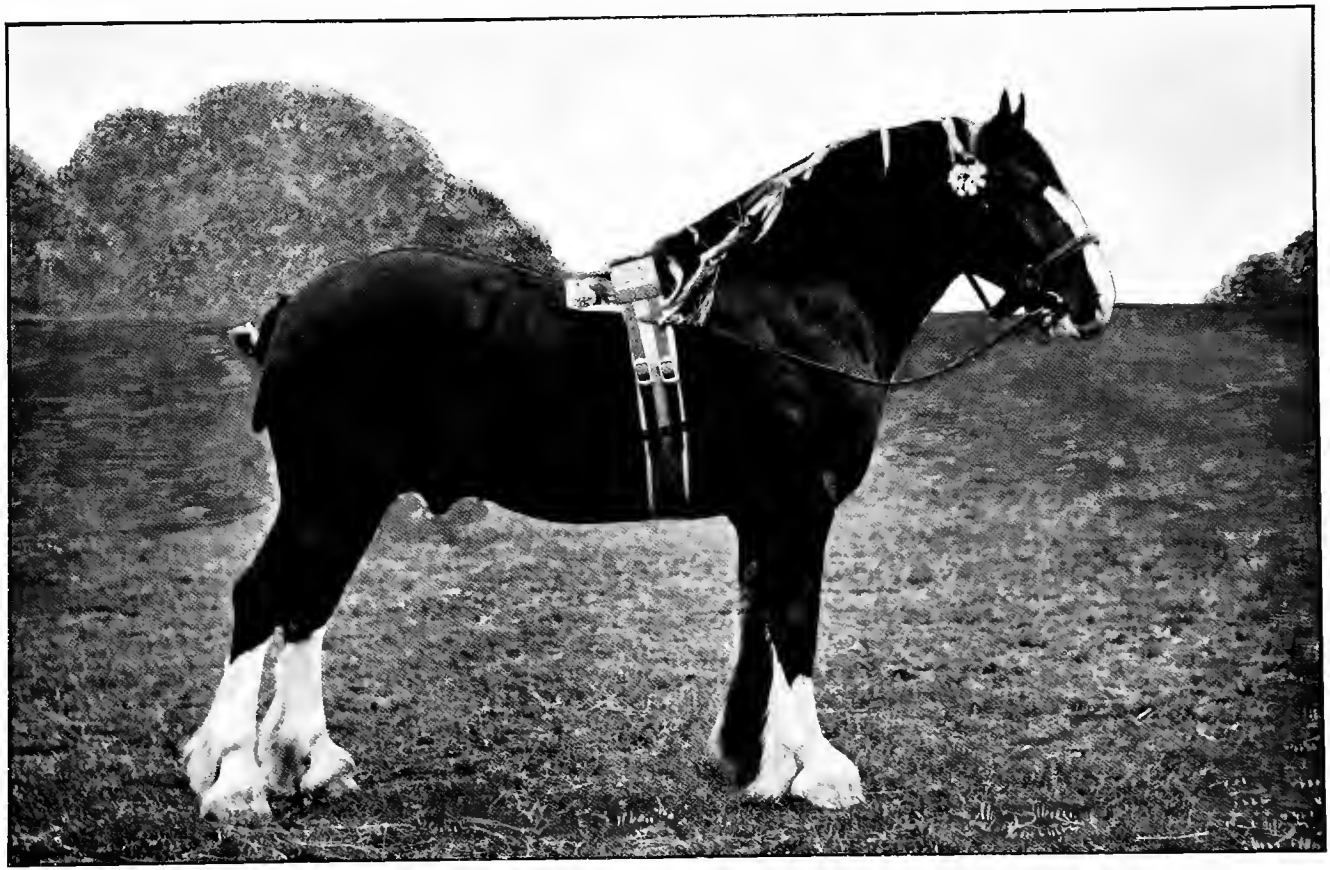


PLATE 10

CLYDESDALE STALLION, "BARON'S PRIDE," 9122.

THE PROPERTY OF MESSRS A. AND W. MONTGOMERY, NETHERHALL, AND BANKS, KIRKCUDBRIGHT.

PLATE II

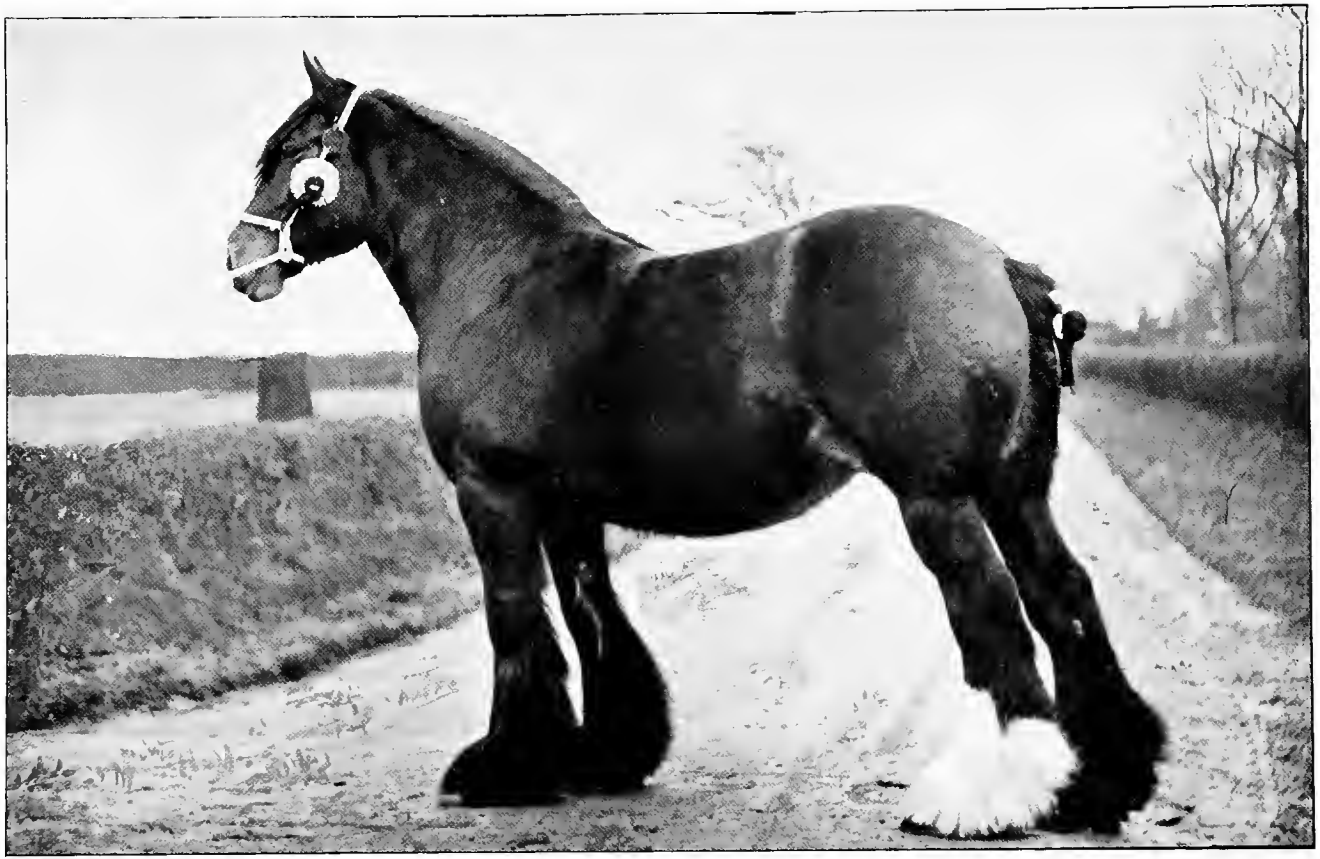
CLYDESDALE MARE, "PYRENE."

THE PROPERTY OF J. E. KERR, ESQ., HARVIESTOUN CASTLE, DOLLAR.

PLATE 12

SHIRE STALLION, "BIRDSALL MENESTREL," 19,357.

THE PROPERTY OF LORD ROTHSCHILD, TRING PARK, HERTS.



SHIRE MARE, "PAINTON SOARIS."

PLATE 15

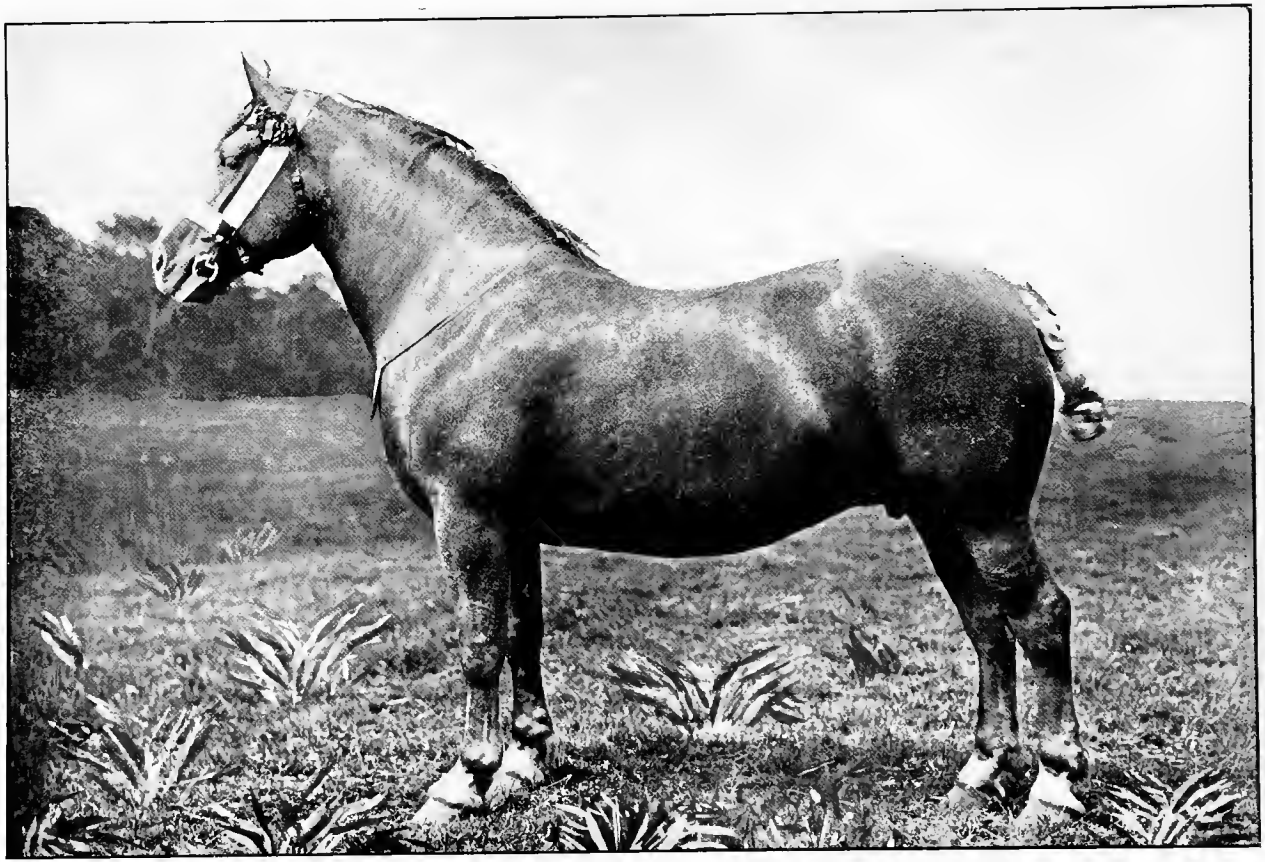


PLATE 14

SUFFOLK MARE, "BOULGE MAID," 4840.

THE PROPERTY OF R. E. WHITE, ESQ., BOULGE HALL, WOODBRIDGE.

PLATE 15

SUFFOLK STALLION, "RENDLESHAM SORCERER," 3077.

THE PROPERTY OF A. J. SMITH, ESQ., RENDLESHAM, WOODBRIDGE.

PLATE 16

THOROUGHBRED STALLION, "DIAMOND JUBILEE."

WON THE DERBY IN 1900 FOR HIS MAJESTY THE KING (THEN PRINCE OF WALES).

PLATE 17

HUNTER GELDING, "WHISKY."

THE PROPERTY OF J. H. STOKES, ESQ., GREAT BOWDEN, MARKET HARBORO'.

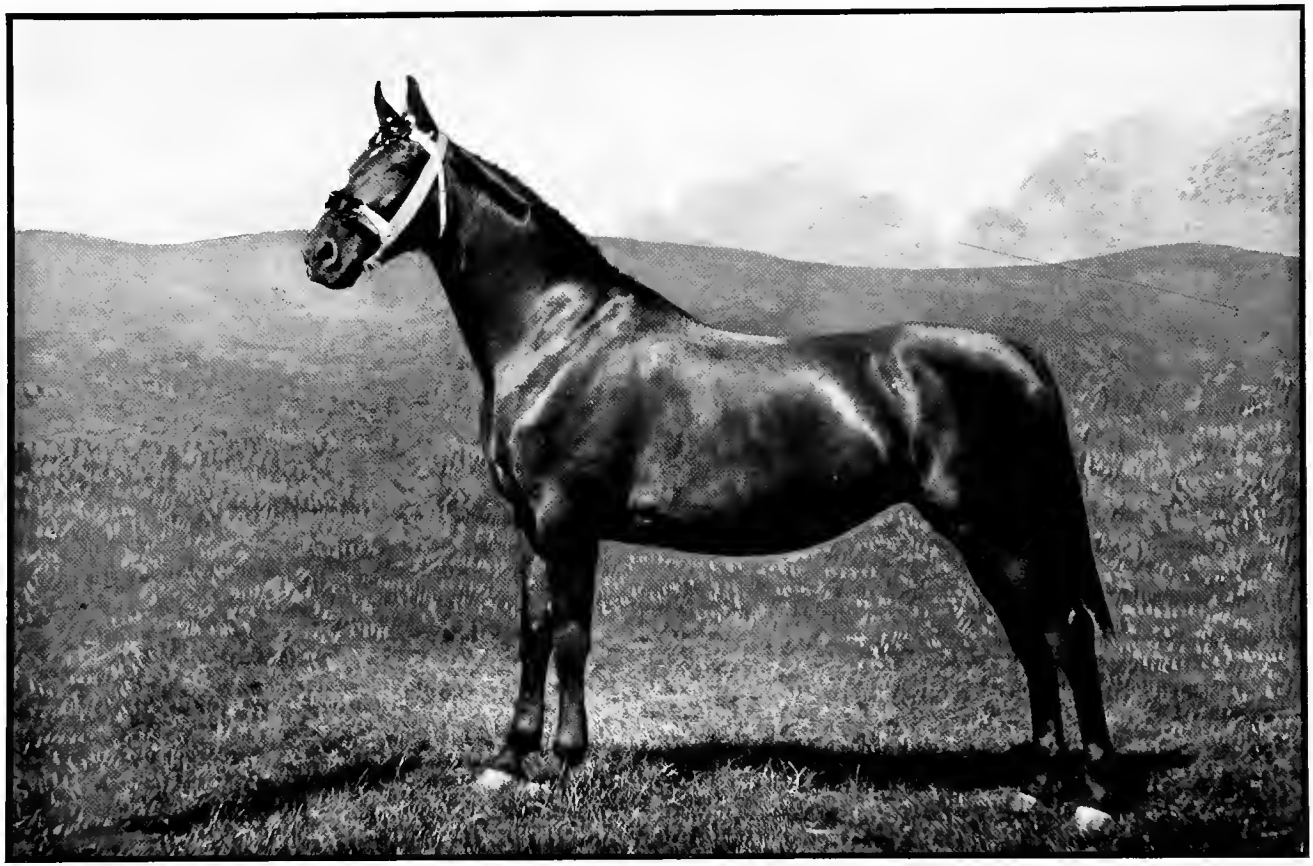


PLATE 18

CLEVELAND BAY MARE, "WOODLAND BRIAR," 1518.

THE PROPERTY OF GEORGE GRANDAGE, ESQ., MOOR CROFT, YEADON, LEEDS.

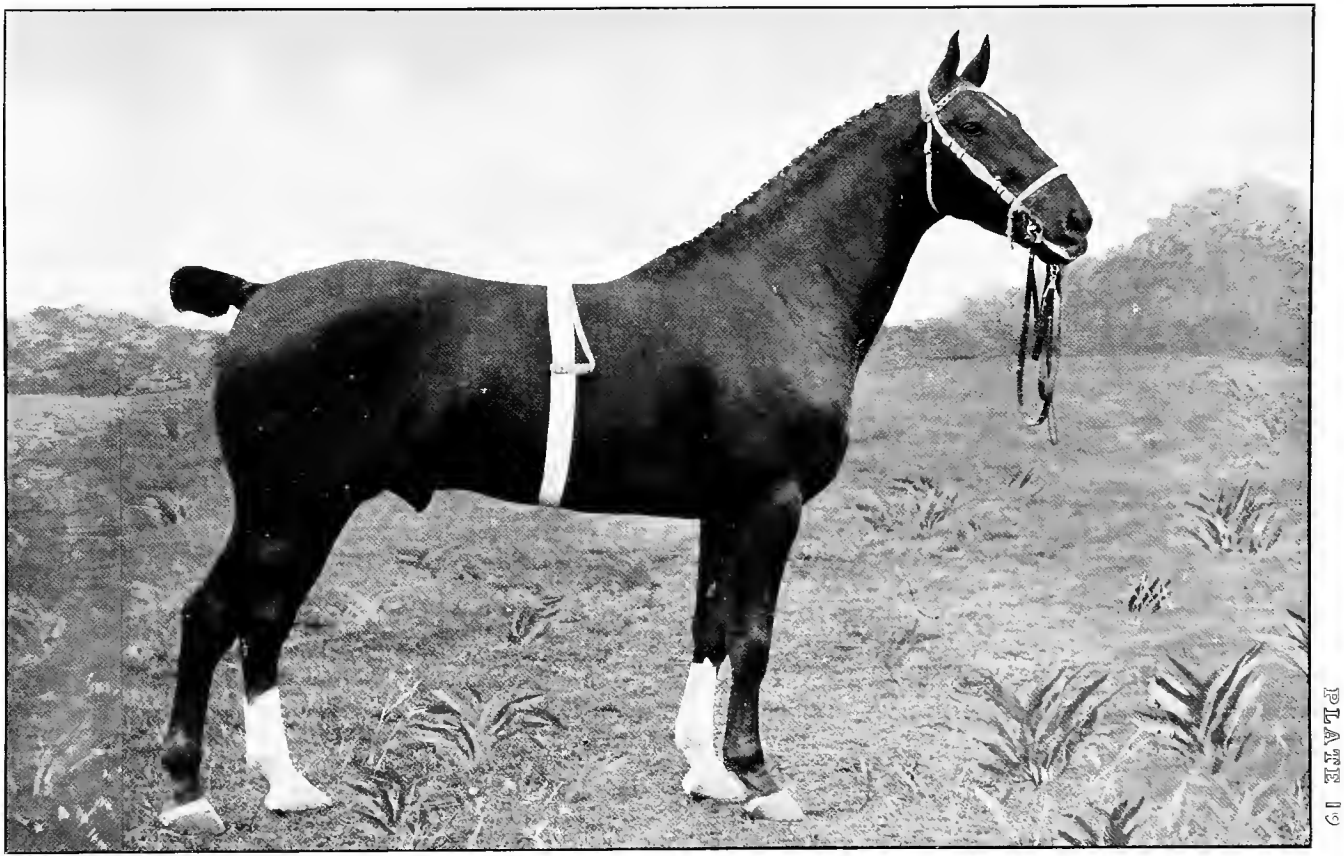
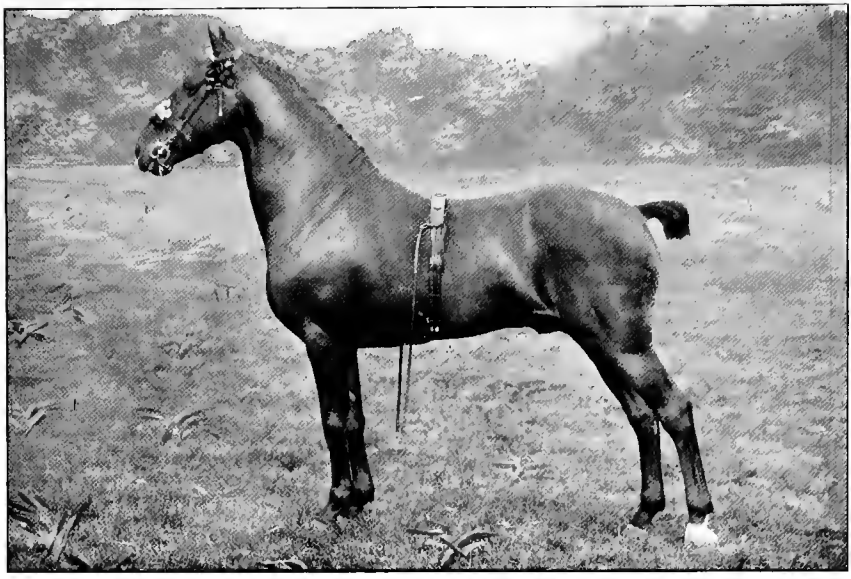


PLATE 19

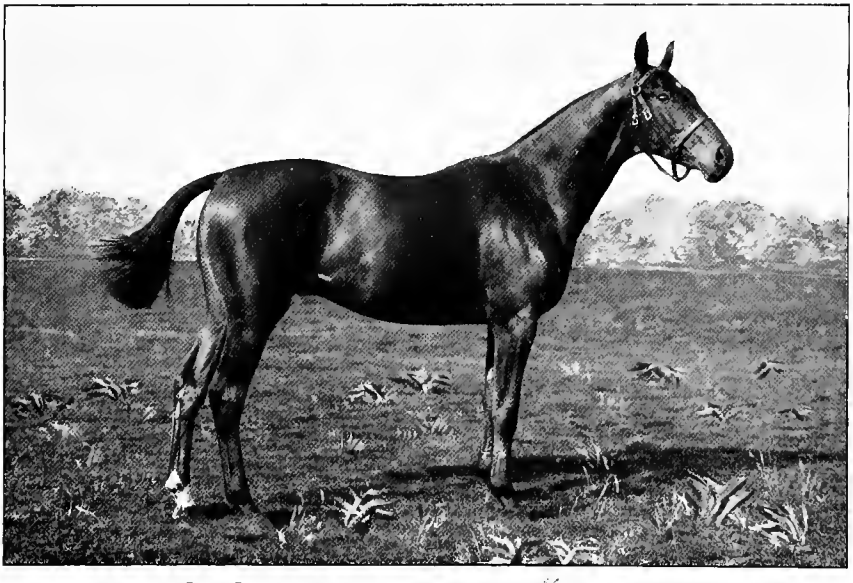
HACKNEY STALLION, "COPMANTHORPE PERFORMER," 9670.

THE PROPERTY OF ARTHUR HALL, ESQ., COPMANTHORPE, YORK



PONY STALLION, "BANTAM KING," 9106.

THE PROPERTY OF W. S. MILLER, ESQ., GLENDERMOT, CRAIGMORE, BUTE.

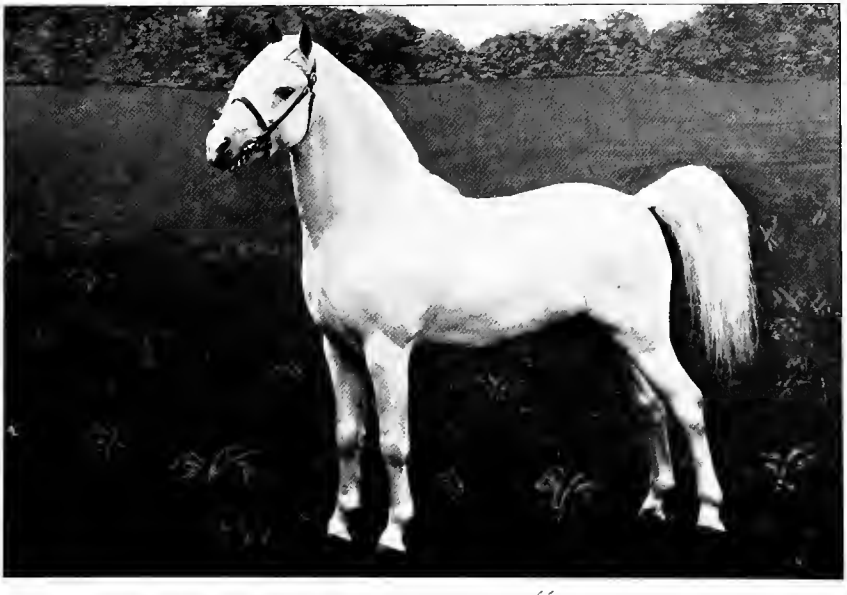


POLO PONY MARE, "RUBY."

THE PROPERTY OF JOHN BARKER, ESQ., M.P., THE GRANGE, BISHOP-STORTFORD.

SHETLAND PONY STALLION, "MARQUIS."

THE PROPERTY OF R. W. R. MACKENZIE, ESQ., EARLSHALL, LEUCHARS, FIFE.



WELSH PONY STALLION, "GREYLIGHT."

THE PROPERTY OF E. JONES, ESQ., MANORAVON, LLANDILO, SOUTH WALES.

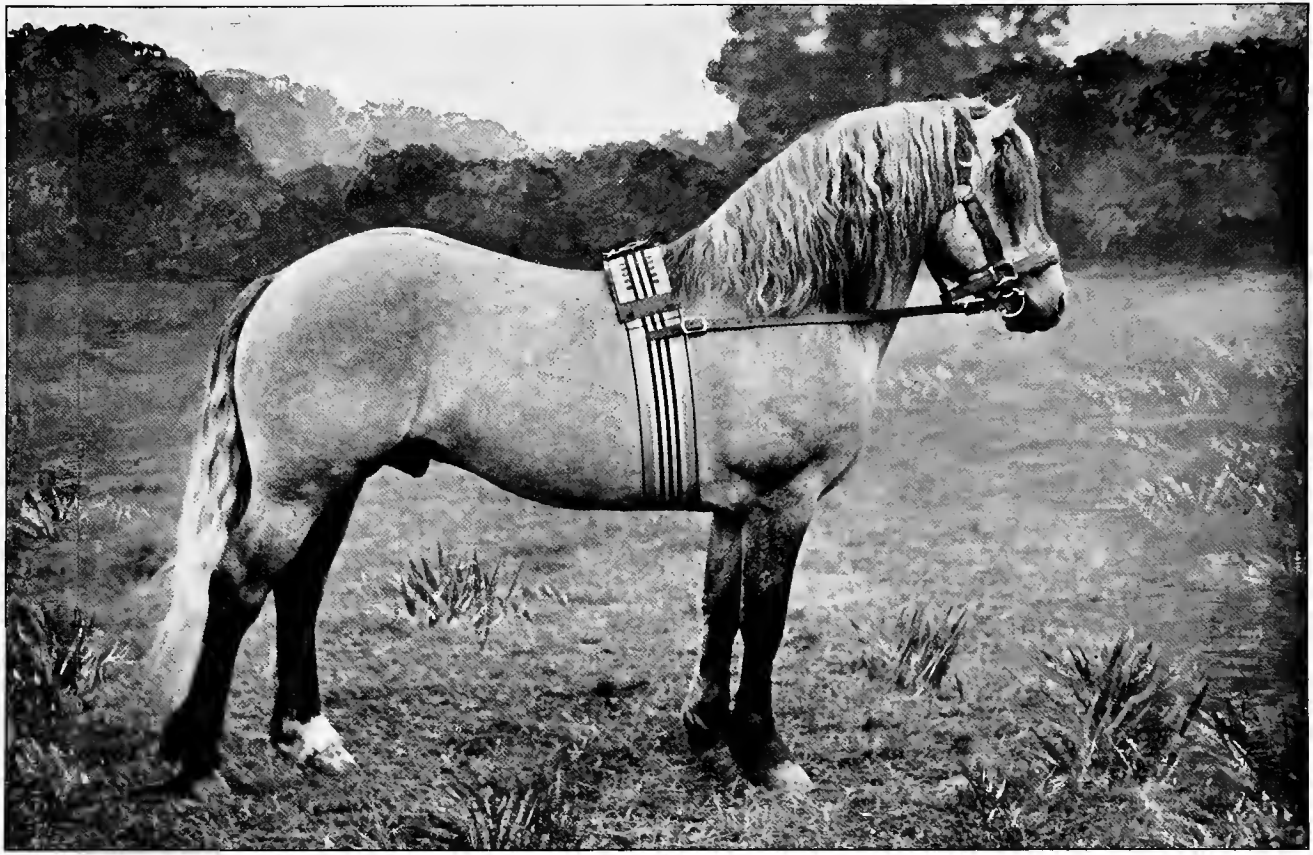
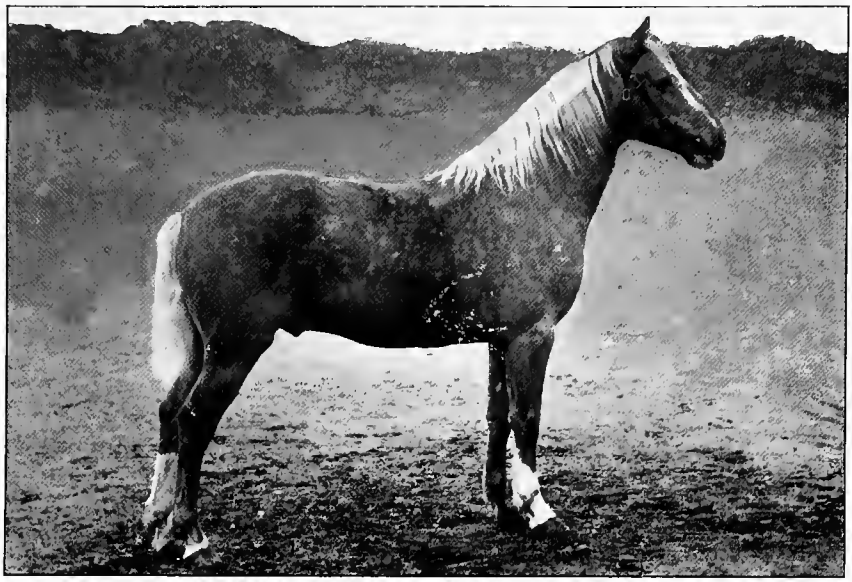


PLATE 22

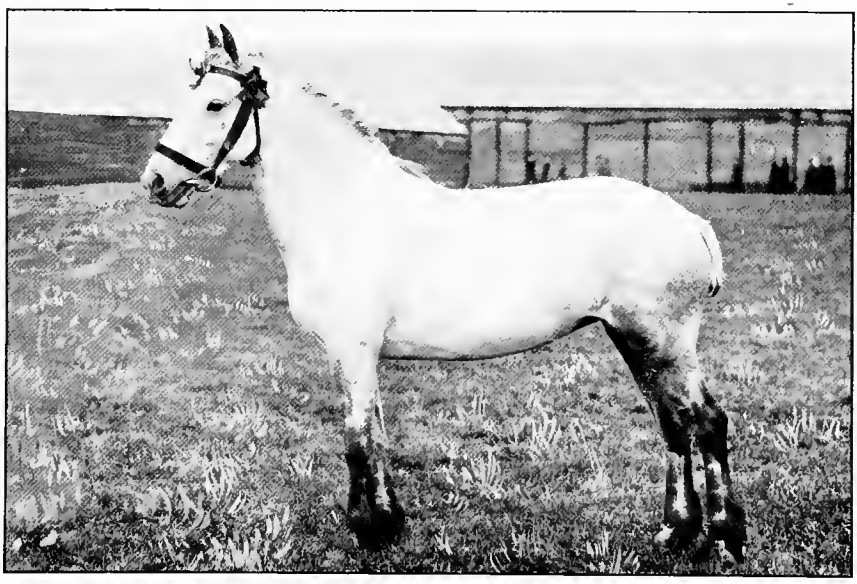
HIGHLAND PONY STALLION, "BONNIE LADDIE," 329.

THE PROPERTY OF HIS GRACE THE DUKE OF ATHOLL, K.T.



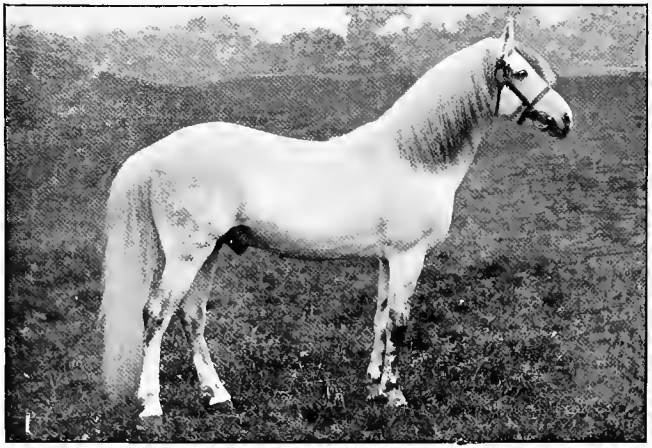
CONNEMARA PONY.

THE PROPERTY OF THE IRISH DEPARTMENT OF AGRICULTURE.



FELL PONY MARE, "GREY LADY."

THE PROPERTY OF W. LITTLE, ESQ., GLADENHOLM, AMISFIELD, DUMFRIES.



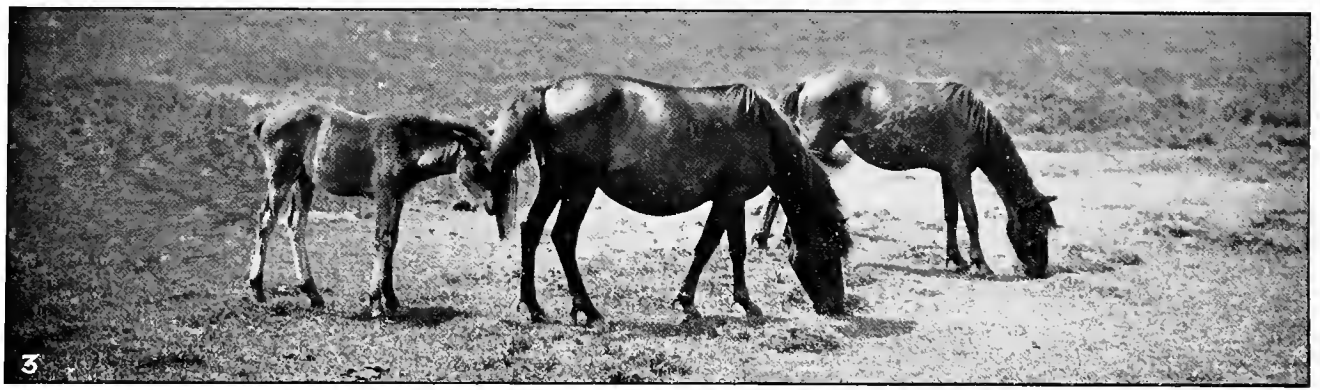
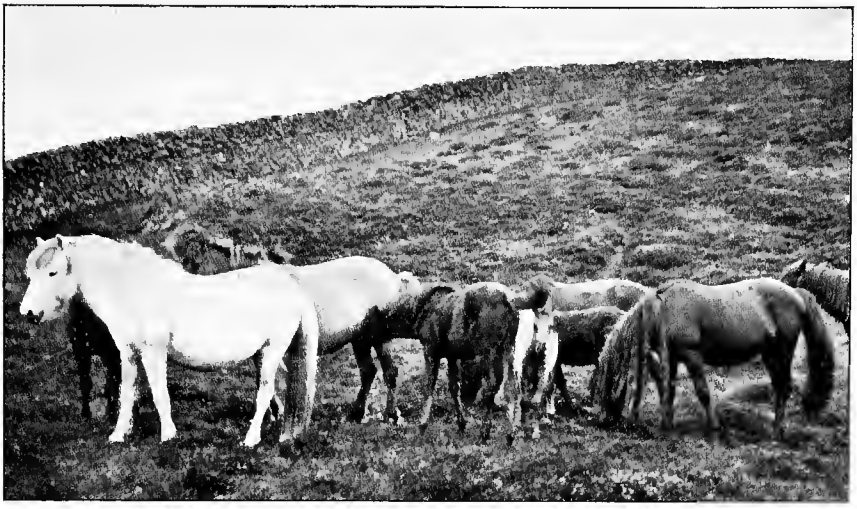


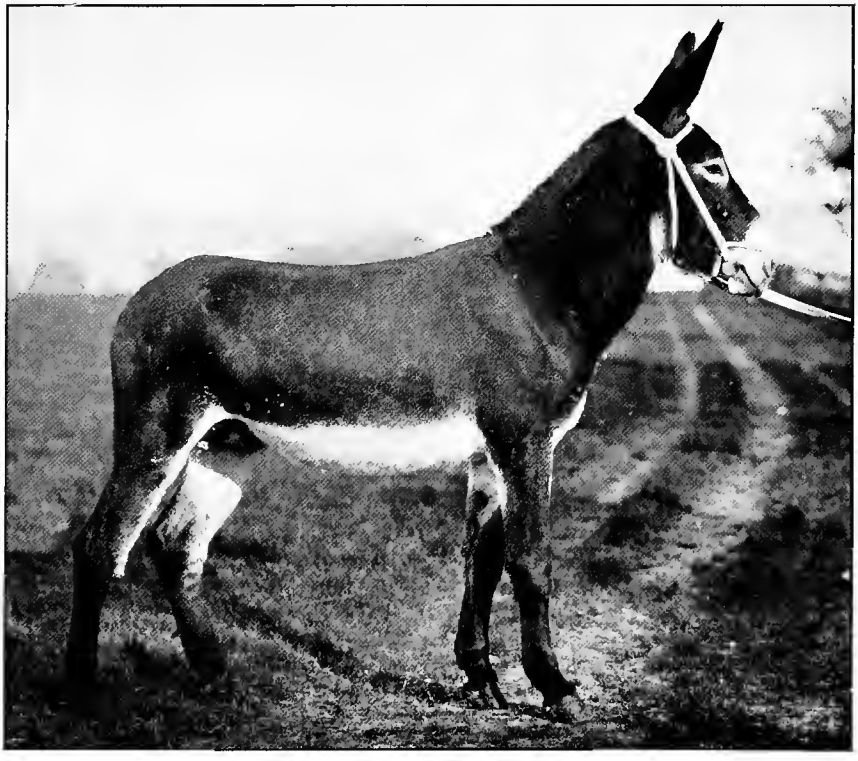
PLATE 24

1. EXMOOR PONY STALLION, "TWILIGHT. 2. DARTMOOR PONY. 3. NEW FOREST PONIES.



GROUP OF PONIES.

ICELAND AND NORWEGIAN. RUM STALLION.



DONKEY STALLION.

THE PROPERTY OF HAROLD SESSIONS, ESQ., WOOTON MANOR, HENLEY-ON-THAMES.

PLATE 26

SHORTHORN BULL, "RONALD," 79,775.

THE PROPERTY OF HIS MAJESTY KING EDWARD VII.

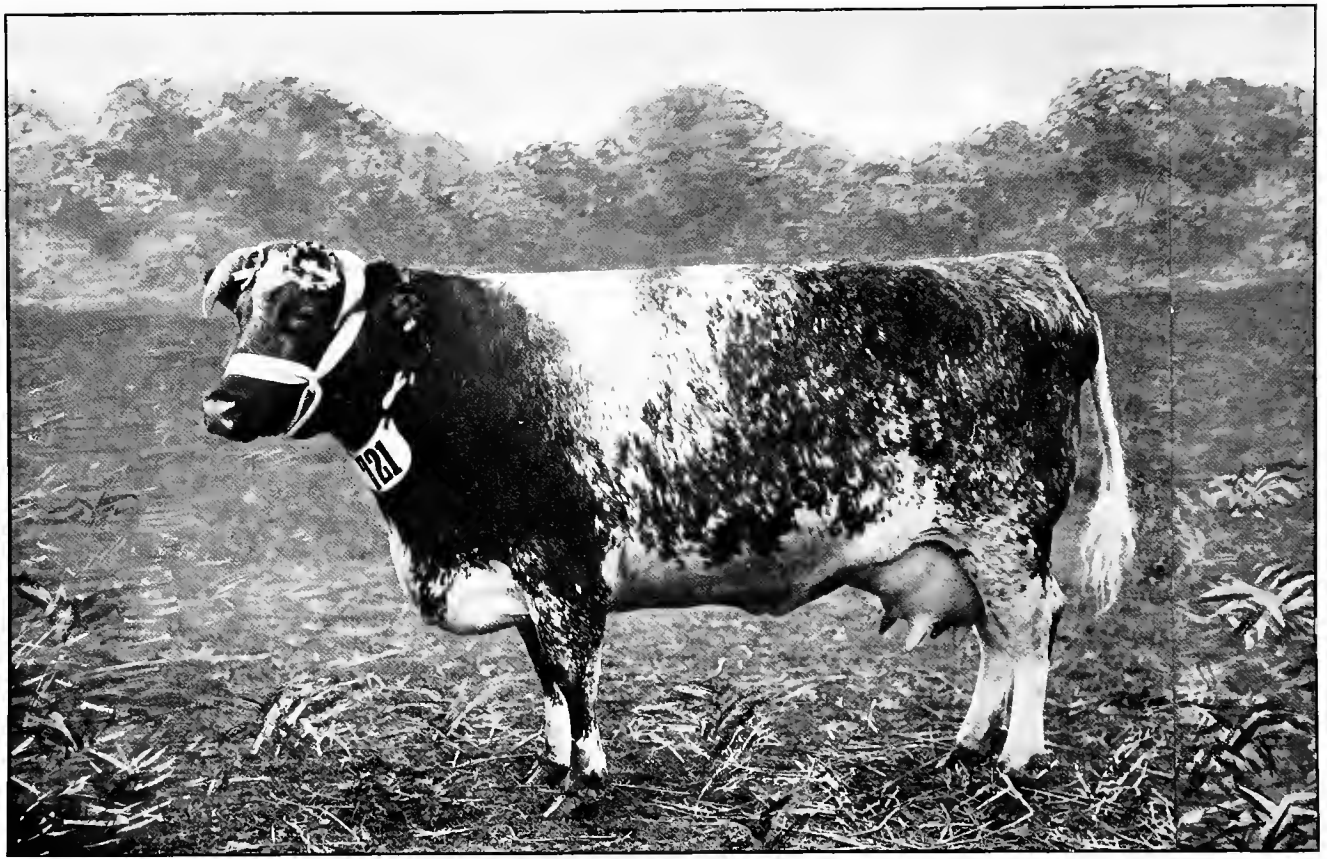


PLATE 27

SHORTHORN COW, "SWEETHEART."

THE PROPERTY OF LORD CALTHORPE, ELVETHAM PARK, WINCHFIELD, HAMPSHIRE.

PLATE 28

LINCOLN RED SHORTHORN COW, "KEDDINGTON SKIPWORTH 5TH."

THE PROPERTY OF JOSEPH GROUT WILLIAMS, ESQ., PENDLEY MANOR, TRING.

PLATE 29

HEREFORD BULL, "CAMERONIAN," 25,954.

THE PROPERTY OF CAPTAIN E. L. A. HEYGATE, BUCKLAND, LEOMINSTER.

PLATE 30

HEREFORD COW, "MERRIMENT."

THE PROPERTY OF THE EARL OF COVENTRY, CROOME COURT, SEVERN STOKE, WORCESTER.

PLATE 31

DEVON BULL, "POUND PINK 'UN," 5350.

THE PROPERTY OF THE HON. E. W. B. PORTMAN, HESTERCOMBE, TAUNTON.

PLATE 32

SOUTH DEVON BULL, "MACBETH," 1924.

THE PROPERTY OF J. SPARROW WROTH, ESQ., COOMBE, AVETON-GIFFORD.

PLATE 33

SUSSEX COW, "SUNLIGHT 5TH."

THE PROPERTY OF EARL WINTERTON, SHILLINGLEE PARK, PETWORTH, SUSSEX.

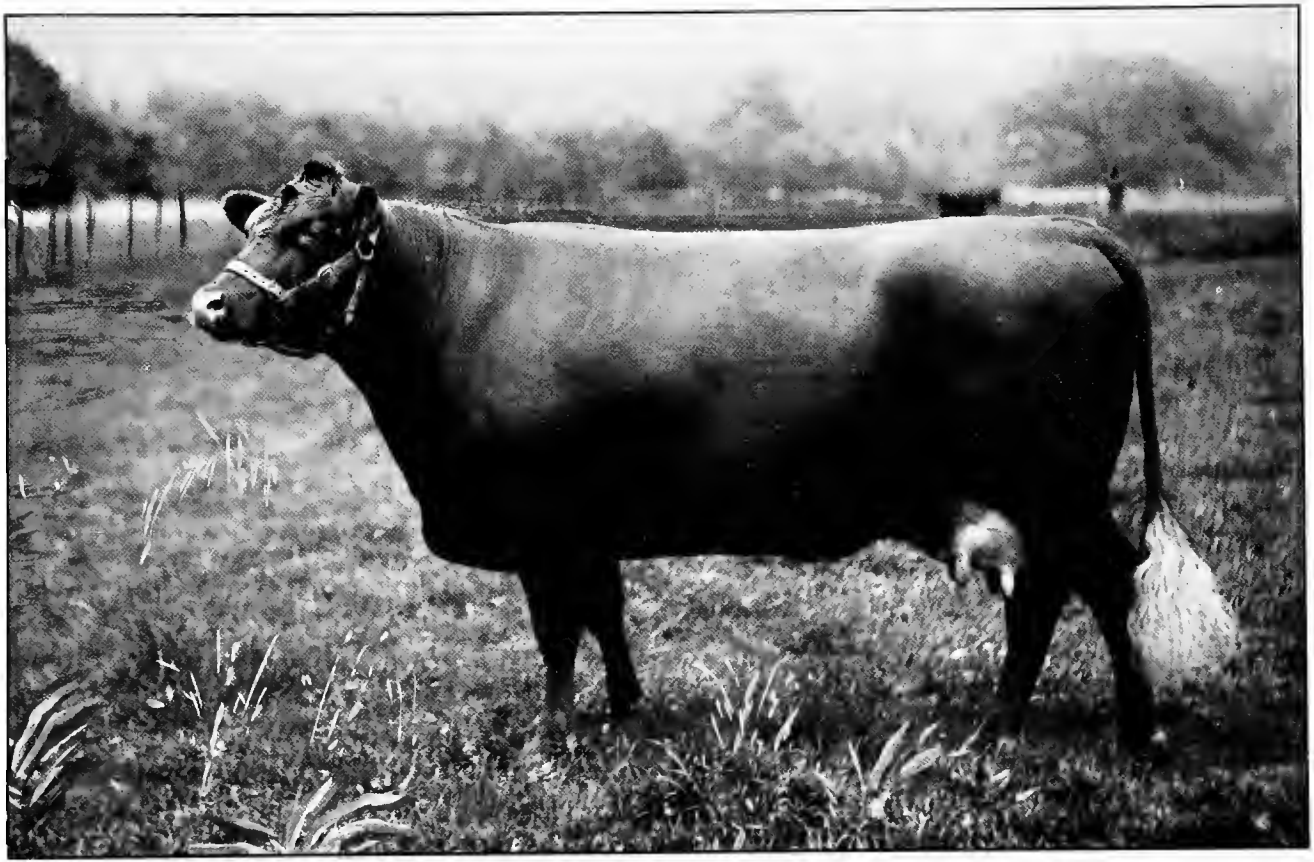


PLATE 34

RED POLLED COW, "WAXLIGHT 2ND," 18,965.

THE PROPERTY OF SIR WALTER CORBET, BART., ACTON REYNOLD, SHREWSBURY.

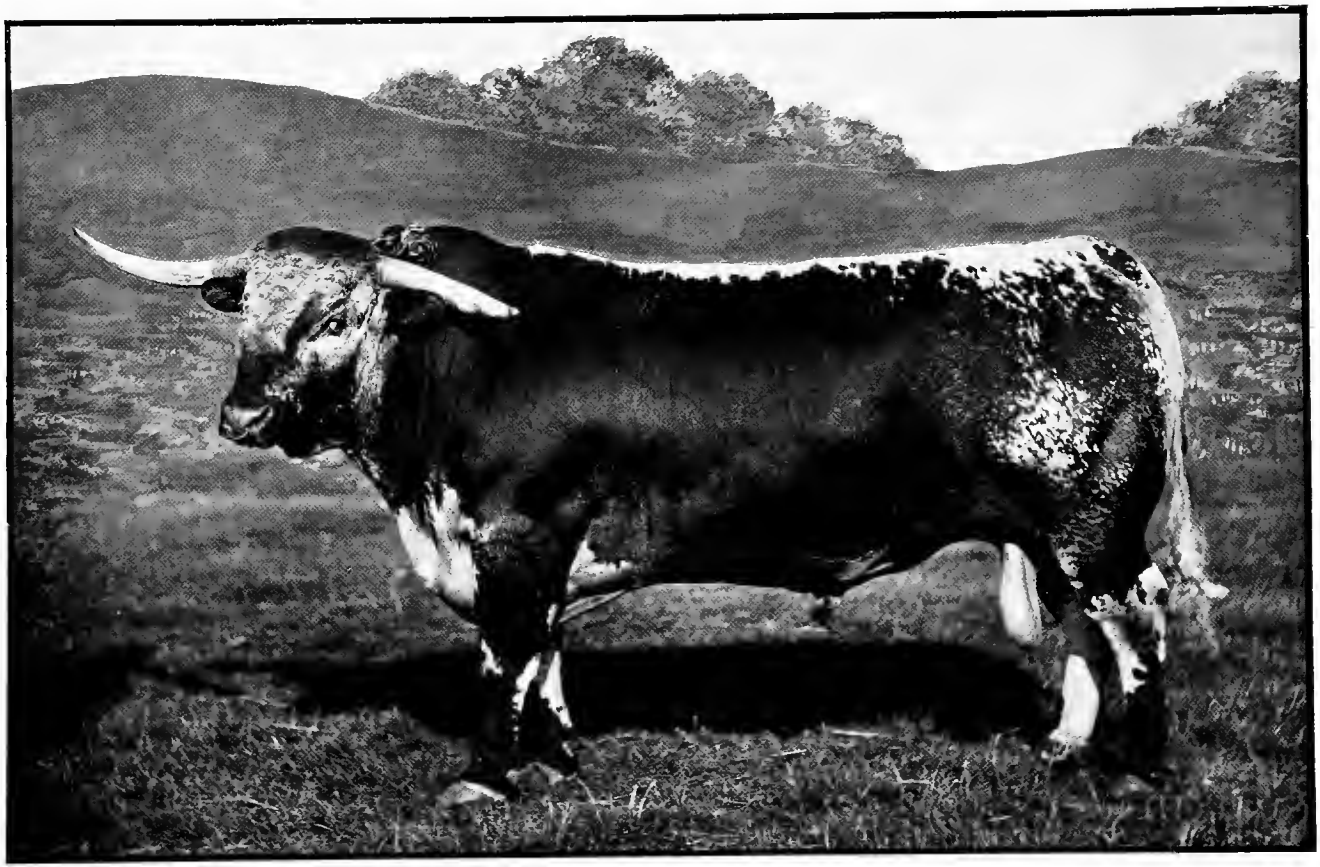


PLATE 35

LONGHORN BULL, "MELCOMBE EMPEROR," 416.

THE PROPERTY OF LORD GERARD, EASTWELL PARK, ASHFORD, KENT.

PLATE 36

ABERDEEN-ANGUS BULL, "JESHURUN," 19,257.

THE PROPERTY OF SIR JOHN MACPHERSON GRANT, BART., BALLINDALLOCH CASTLE, BALLINDALLOCH.

PLATE 37

ABERDEEN-ANGUS COW, "JUANA ERICA," 36,235.

THE PROPERTY OF J. E. KERR, ESQ., OF HARVIESTOUN CASTLE, DOLLAR.

PLATE 38

GALLOWAY BULL, "KEYSTONE," 9639.

THE PROPERTY OF F. N. M. GOURLAY, ESQ., BROOMFIELD, MONIAIVE, DUMFRIESSHIRE.

PLATE 36

GALLOWAY COW, "ALICE III. OF CASTLEMILK," 16,867.

THE PROPERTY OF SIR WILLIAM BUCHANAN-JARDINE, BART. OF CASTLEMILK, LOCKERBIE.

PLATE 40

HIGHLAND BULL, "LORD CLYDE," 2034.

THE PROPERTY OF THE COUNTESS DOWAGER OF SEAFIELD.

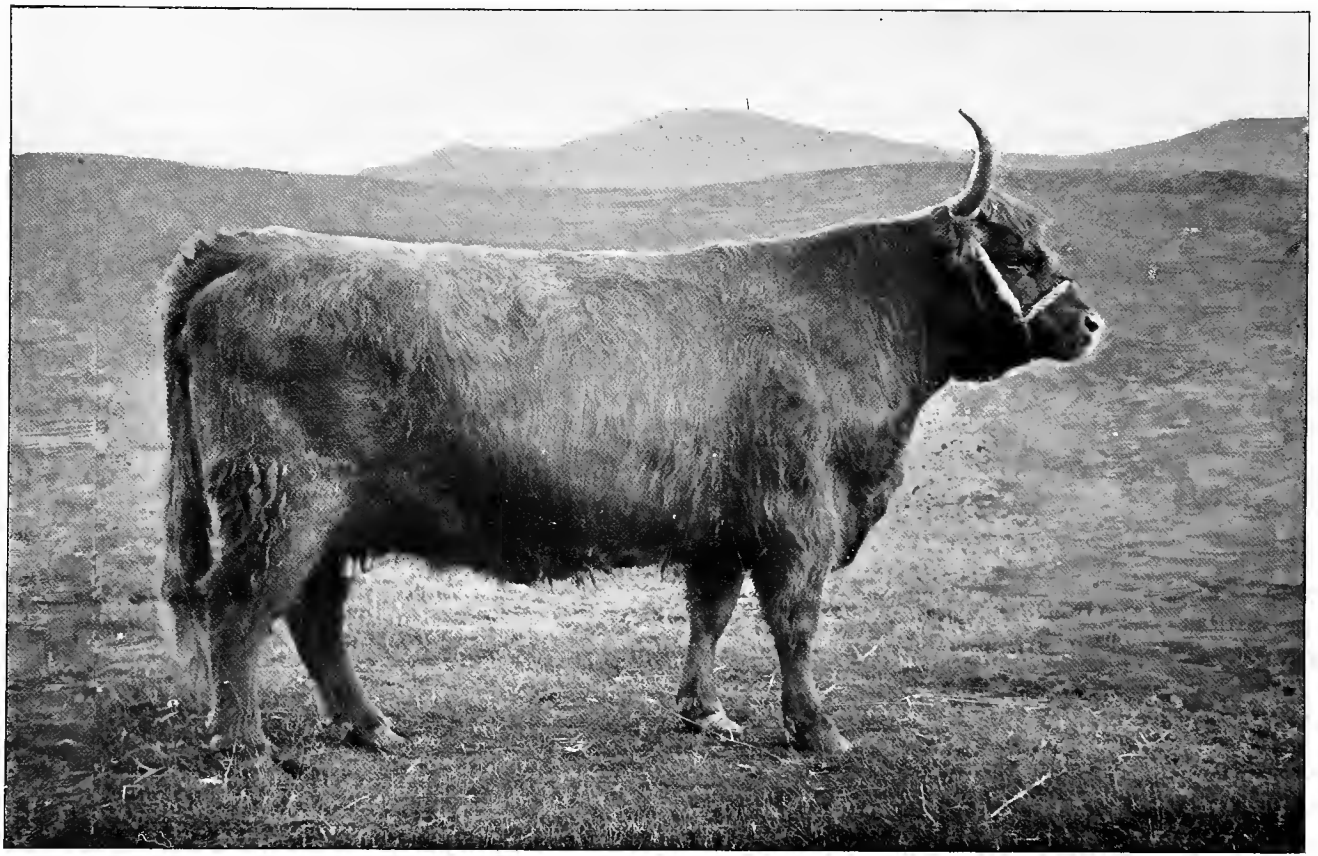


PLATE 41

HIGHLAND COW.

THE PROPERTY OF DONALD A. STEWART, ESQ., INSCH, PORTREE.

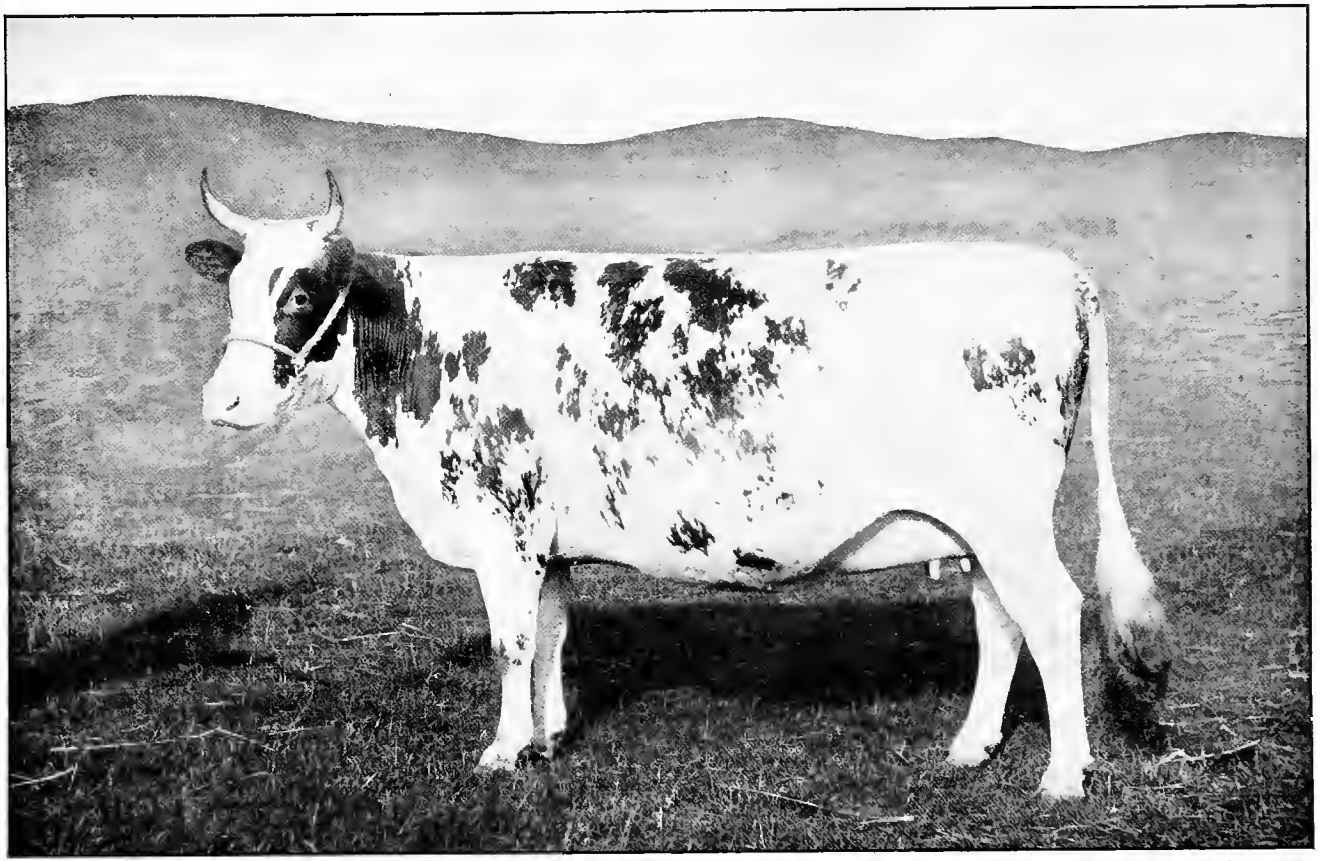


PLATE 42

AYRSHIRE COW, "AUCHENTORLIE BLOOMER," 16644.

THE PROPERTY OF LIEUT.-COLONEL FERGUSSON-BUCHANAN OF AUCHENTORLIE, BOWLING, DUMBARTONSHIRE.

PLATE 43

WELSH COW, "MADRYN KATE," 595.

THE PROPERTY OF THE UNIVERSITY COLLEGE OF NORTH WALES, BANGOR.

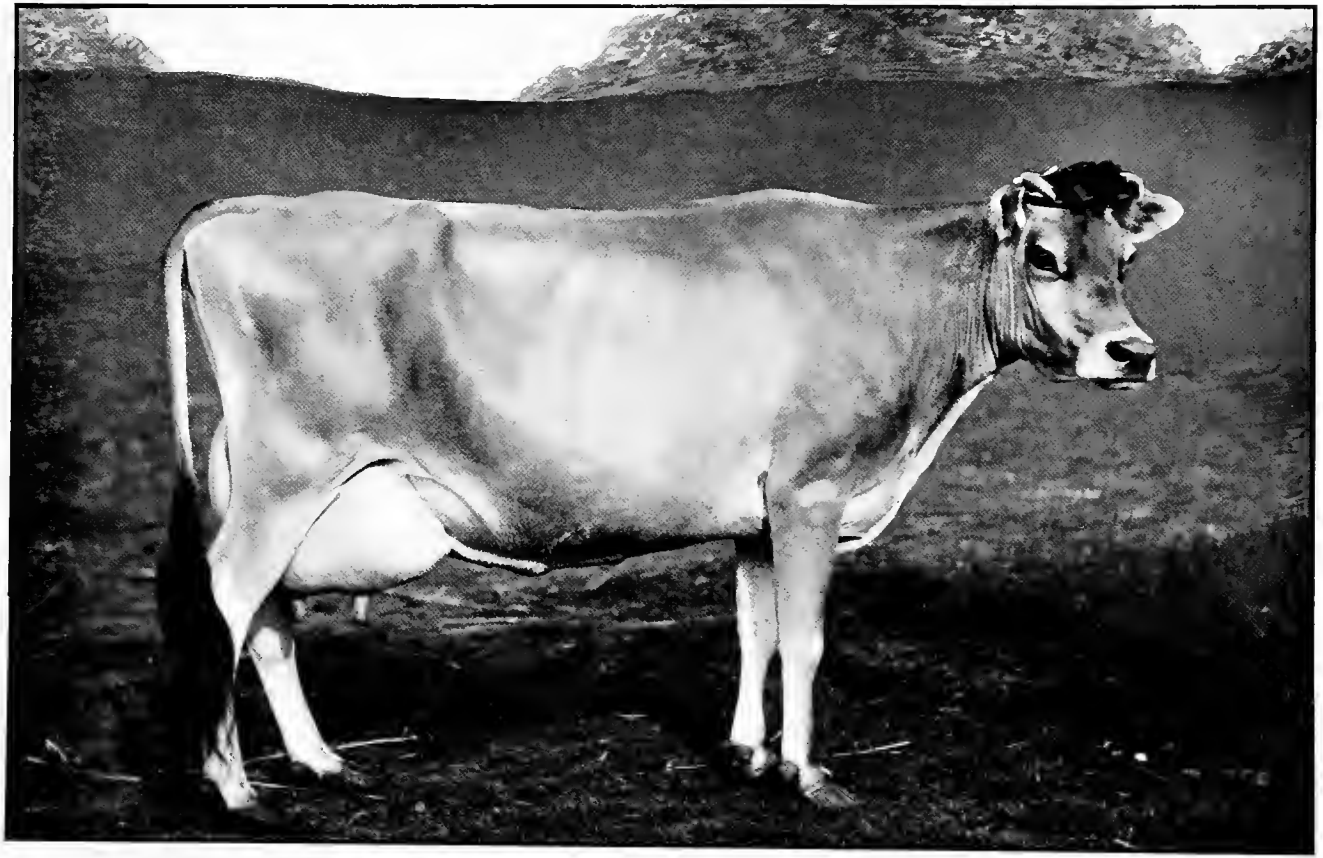


PLATE 44.

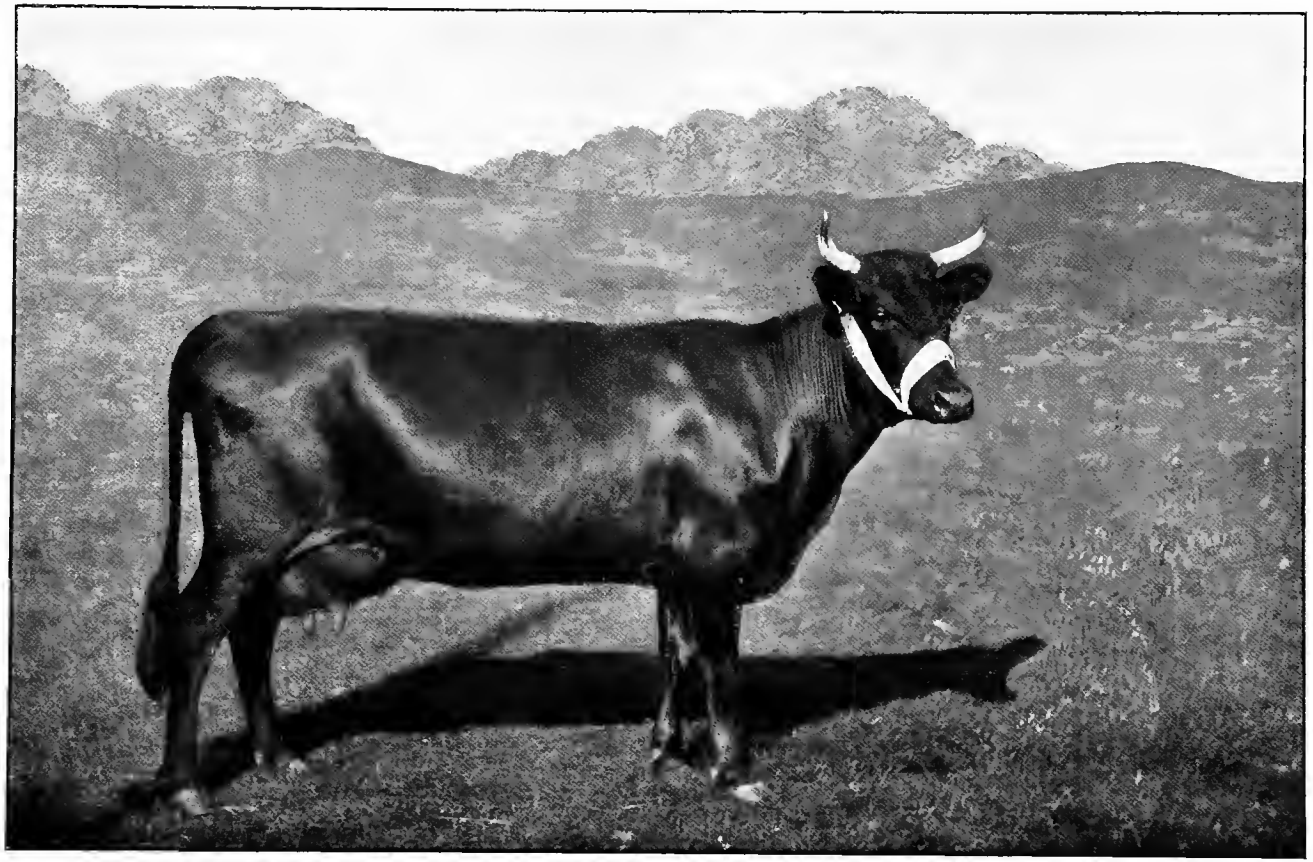
JERSEY COW, "LADY VIOLA."

THE PROPERTY OF ALEXANDER MILLER-HALLETT, ESQ., GODDINGTON, CHELSFIELD, KENT.

PLATE 45

GUERNSEY COW, "FI FI," 5438.

THE PROPERTY OF E. A. HAMBRO, ESQ., HAYES PLACE, HAYES, KENT.



KERRY COW, "WALTON BASHFUL," 871.

PLATE 46

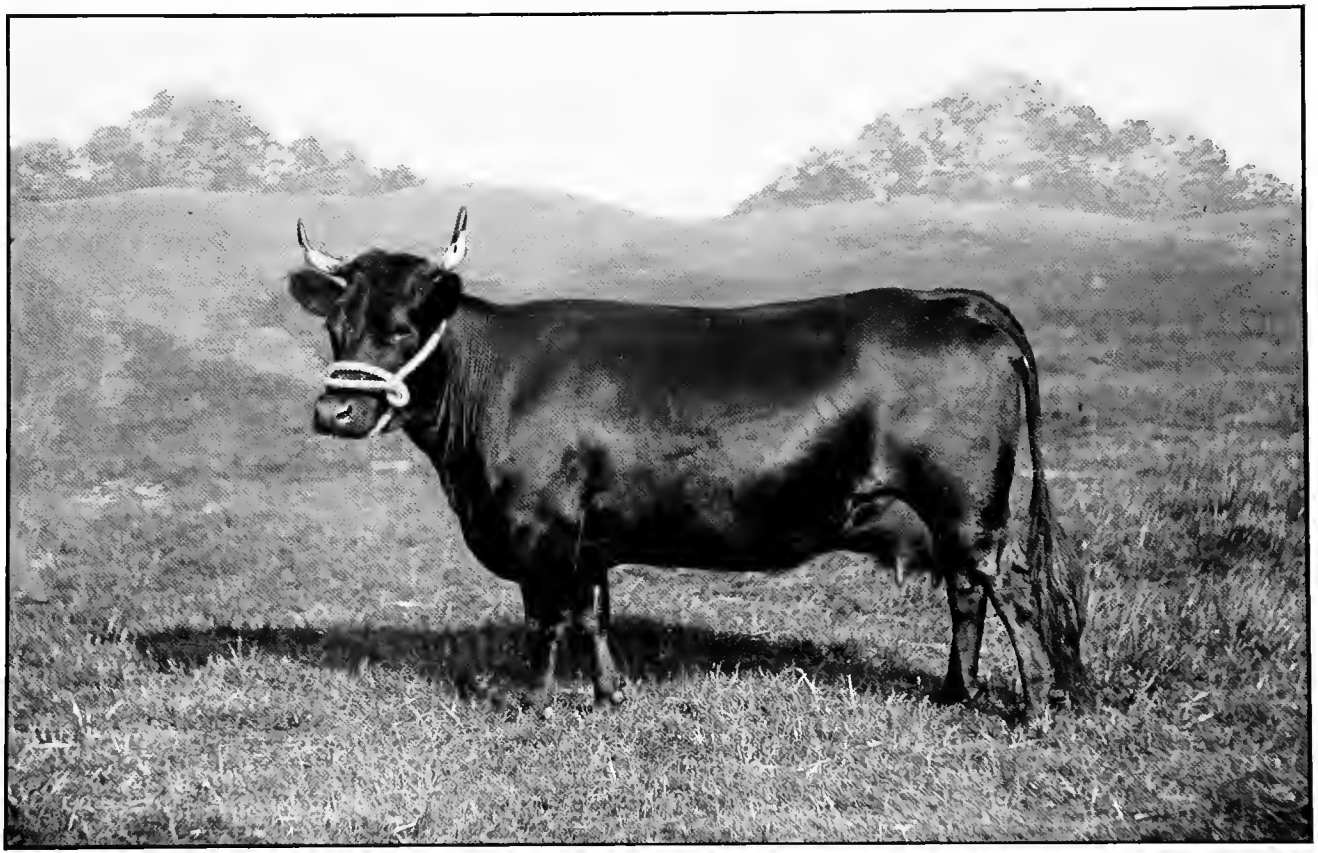


PLATE 47

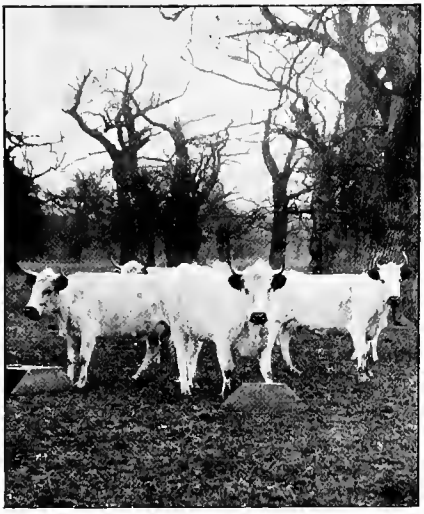
DEXTER COW, "COMPTON DOLLY VARDEN."

THE PROPERTY OF HIS MAJESTY THE KING, SANDRINGHAM, NORFOLK.

PLATE 43

DEXTER-SHORTHORN CATTLE.

DORA. TIDY BELL 3RD. DAISY.



WILD WHITE CATTLE.

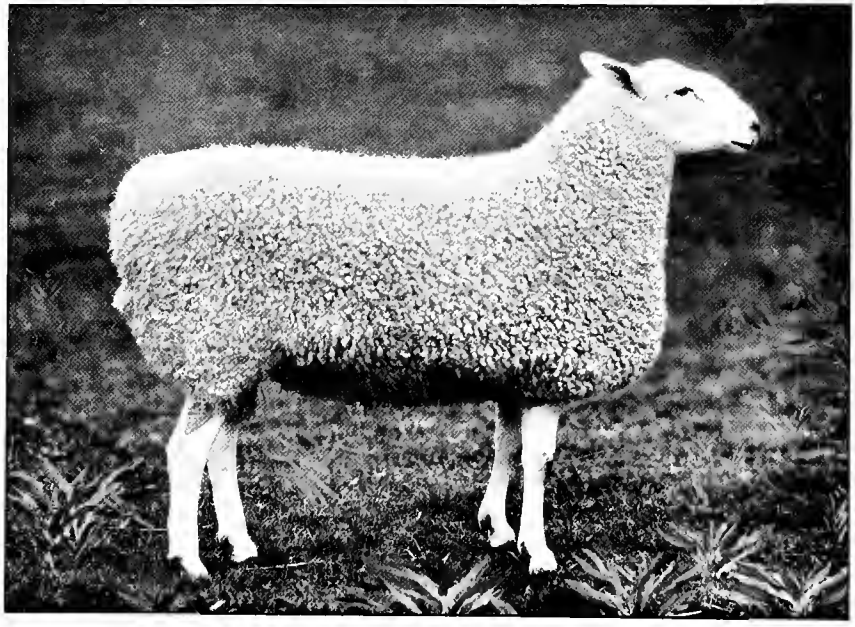
IN CADZOW FOREST. IN VAYNOL PARK.

CHILLINGHAM WILD BULL.

TAKEN TO CADZOW.

LEICESTER RAM.

THE PROPERTY OF GEORGE HARRISON, ESQ., GAINFORD HALL, DARLINGTON.



BORDER LEICESTER RAM.

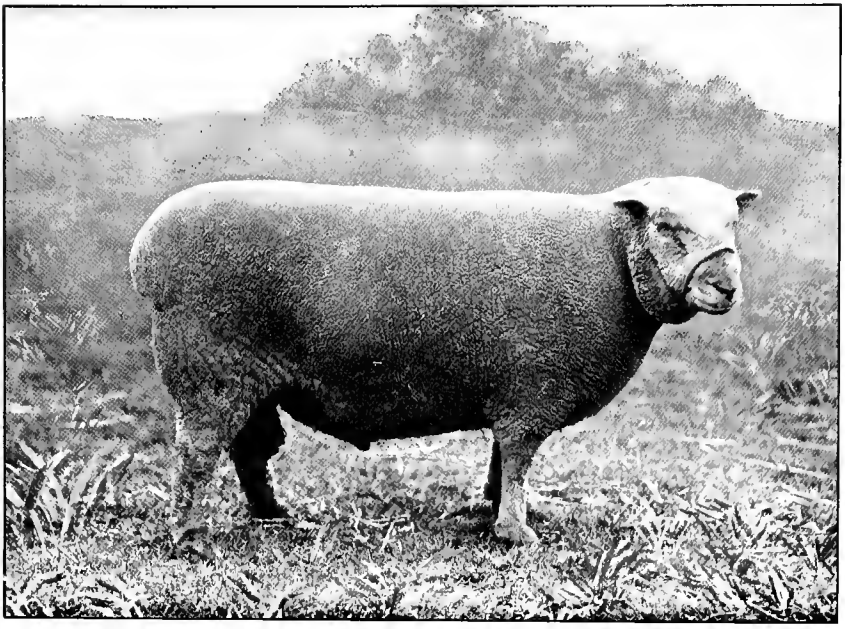
THE PROPERTY OF THE REPRS. OF THE LATE DAVID HUME, ESQ., BARRELWELL, BRECHIN.

LINCOLN RAM.

THE PROPERTY OF F. MILLER, ESQ., CLIFTON ROAD, BIRKENHEAD.

COTSWOLD RAM.

THE PROPERTY OF MESSRS W. T. GARNE AND SON, ALDSWORTH, NORTHLEACH.



TWO-SHEAR SOUTHDOWN RAM.

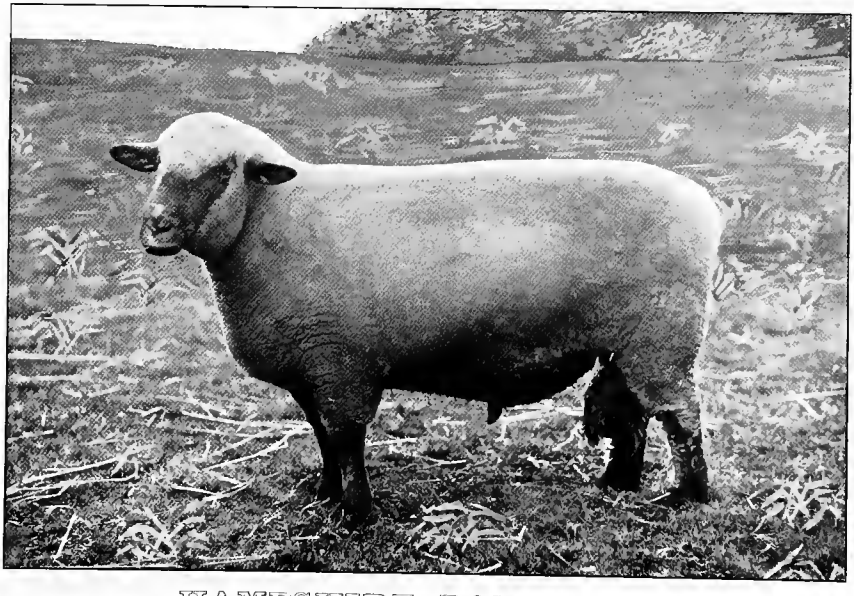
THE PROPERTY OF W. M. CAZALET, ESQ., FAIRLAWN, TONBRIDGE.

SHEARLING SHROPSHIRE RAM.

THE PROPERTY OF THOMAS A. BUTTAR, ESQ., CORSTON, COUPAR-ANGUS, FORFARSHIRE.

SHEARLING OXFORD DOWN RAM.

THE PROPERTY OF JAMES T. HOBBS, ESQ., MAISEY HAMPTON, FAIRFORD.



HAMPSHIRE DOWN RAM.

THE PROPERTY OF JAMES FLOWER, ESQ., CHILMARK, SALISBURY.

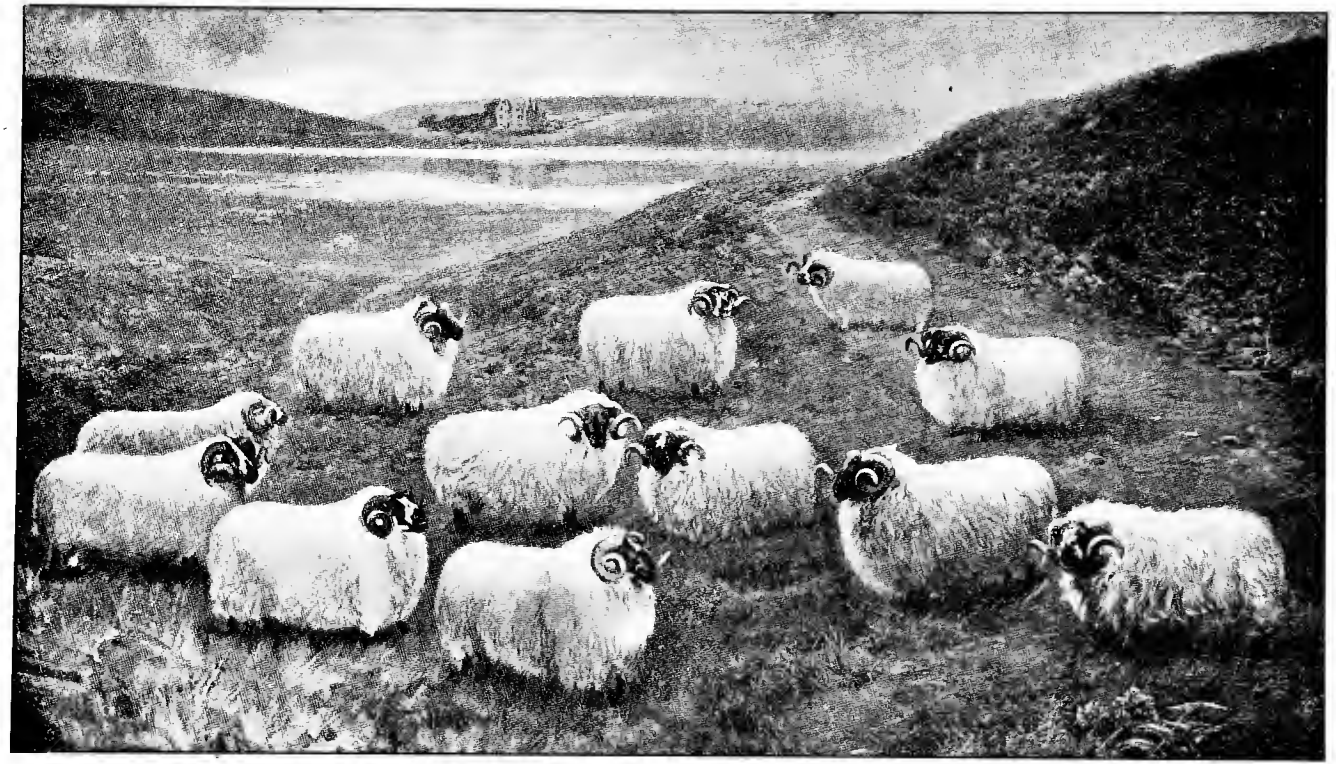


PLATE 54

GROUP OF BLACKFACE RAMS.

BRED BY CHARLES HOWATSON, ESQ. OF GLENBUCK, AYRSHIRE.

TWO-SHEAR BLACKFACE RAM.

THE PROPERTY OF DONALD M'DOUGALL, ESQ., CLAGGAN, KILLIN.

SHEARLING BLACKFACE EWE.

THE PROPERTY OF JOHN MILLER, ESQ., LAMBHILL, STRATHAVEN.

CHEVIOT RAM.

THE PROPERTY OF JOHN ELLIOT, ESQ., HINDHOPE, JEDBURGH.

HALF-BRED RAM.

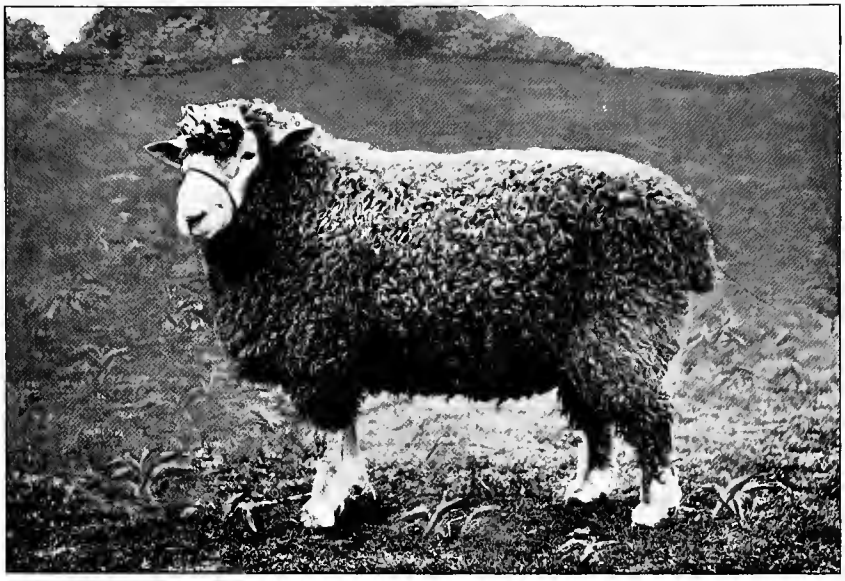
THE PROPERTY OF JAMES A. W. MEIN, ESQ. OF HUNTHILL, JEDBURGH.

RYELAND RAM.

THE PROPERTY OF F. ELLIOTT GOUGH, ESQ., THE MOOR, BODENHAM, LEOMINSTER.

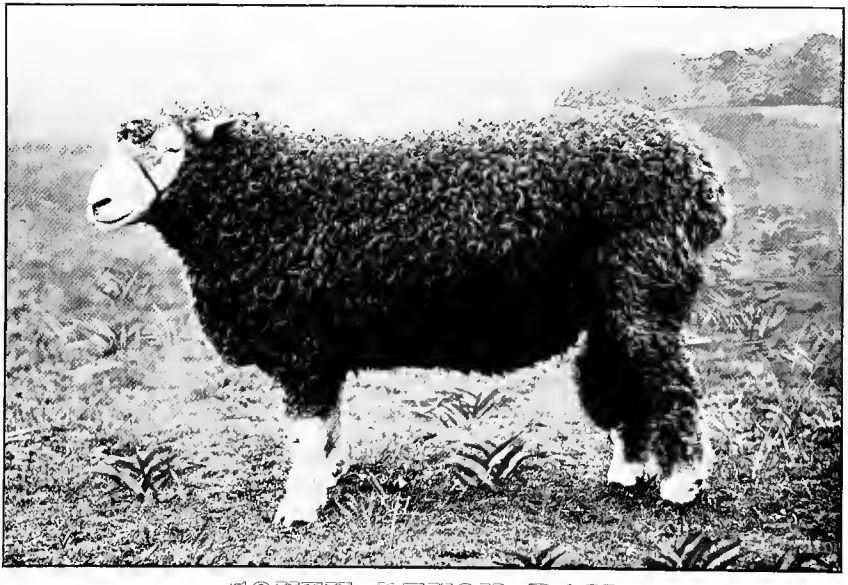
SUFFOLK RAM.

THE PROPERTY OF H. E. SMITH, ESQ., THE GRANGE, WALTON, SUFFOLK.



DEVON LONG-WOOL SHEARLING RAM.

THE PROPERTY OF FREDERICK WHITE, ESQ., TORWESTON, WILLITON, SOMERSET.



SOUTH DEVON RAM.

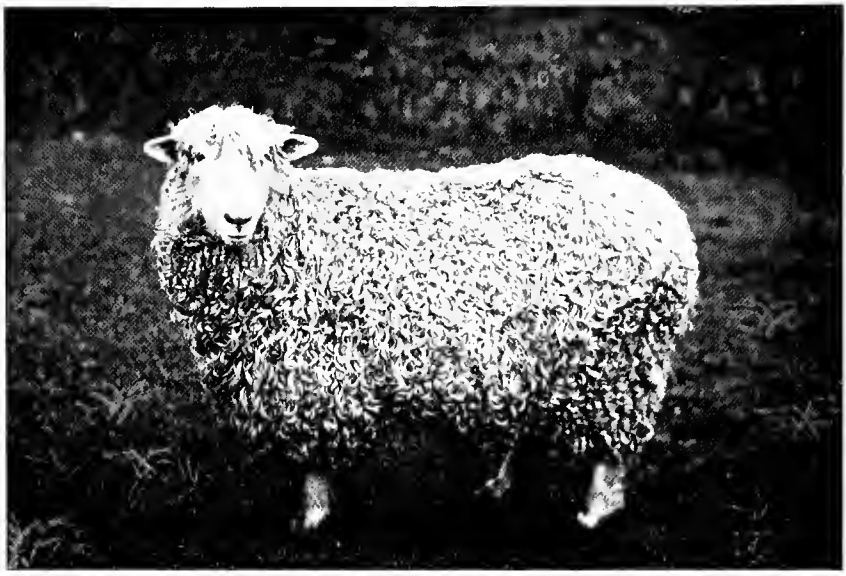
THE PROPERTY OF HENRY FAIRWEATHER, ESQ., MALSTON, SHERFORD, KINGSBRIDGE.

DORSET DOWN RAM.

THE PROPERTY OF G. WOOD HOMER, ESQ., BARDOLF MANOR, DORCHESTER.

DORSET HORN RAM.

THE PROPERTY OF E. A. HAMBRO, ESQ., DELCOMBE FARM, BLANDFORD, DELCOMBE, DORSET.



DARTMOOR SHEARLING RAM.

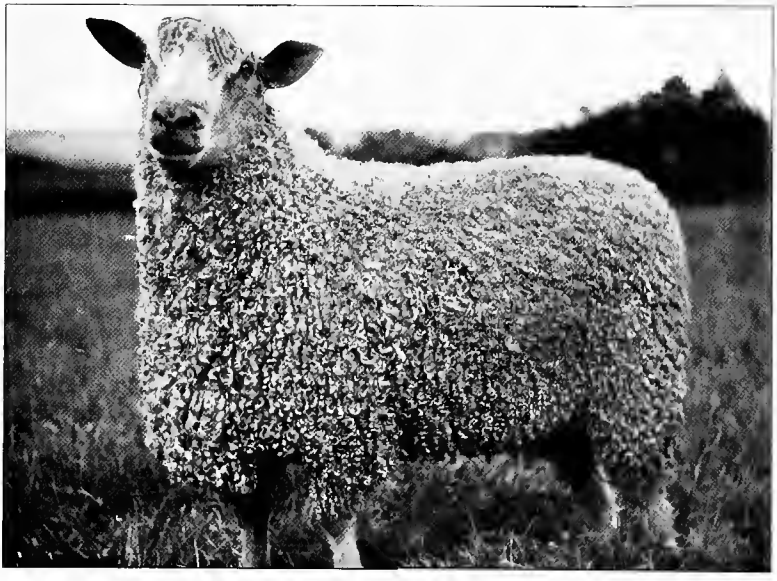
THE PROPERTY OF R. SERCOMBE LUSCOMBE, ESQ., WISDORNE, CORNWOOD, DEVON.

EXMOOR RAM.

THE PROPERTY OF HEBER MARDON, ESQ., ASHWICK, DULVERTON, SOMERSET.

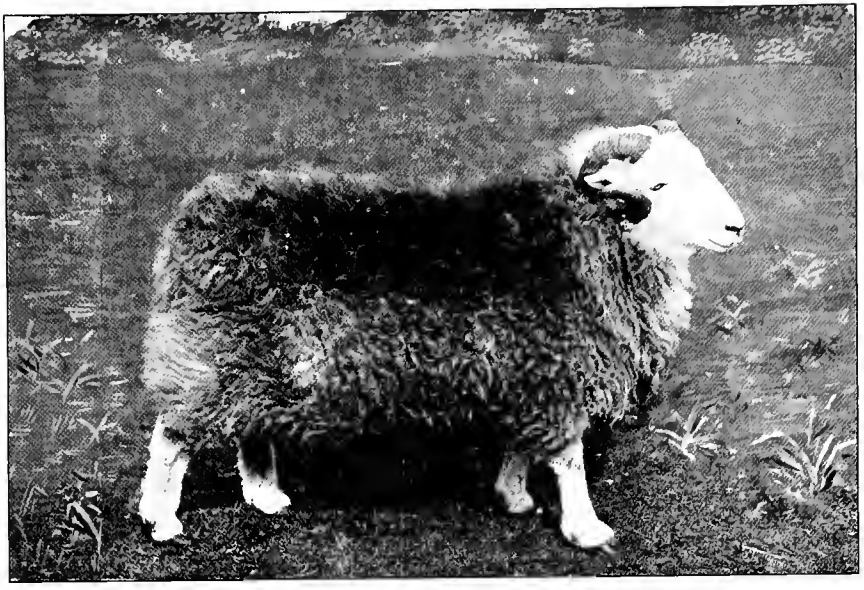
SHEARLING LONK RAM.

THE PROPERTY OF D. HAGUE, ESQ., COPY NOOK, CLITHERO, LANCASHIRE.



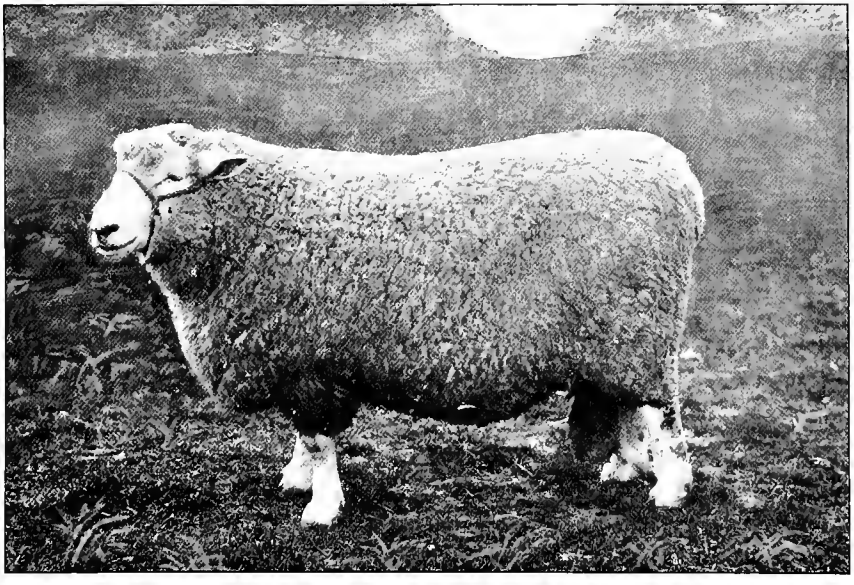
WENSLEYDALE RAM.

THE PROPERTY OF THE EXECUTORS OF THE LATE THOMAS WILLIS, ESQ.,
MANOR HOUSE, CARPERBY, YORKS.



HERDWICK RAM.

THE PROPERTY OF W. J. CROSSLEY, ESQ., M.P., PULLWOODS, AMBLESIDE, WESTMORELAND.

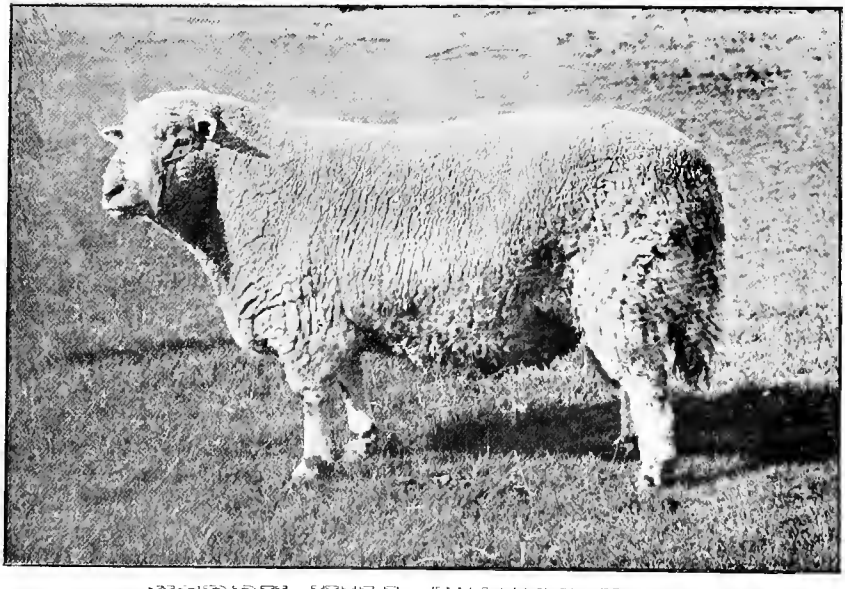


KENT OR ROMNEY MARSH RAM.

THE PROPERTY OF CHARLES FILE, ESQ., ELHAM, CANTERBURY.

WELSH SHEARLING EWES.

THE PROPERTY OF THE UNIVERSITY COLLEGE OF NORTH WALES, BANGOR.



KERRY HILL (WALES) RAM.

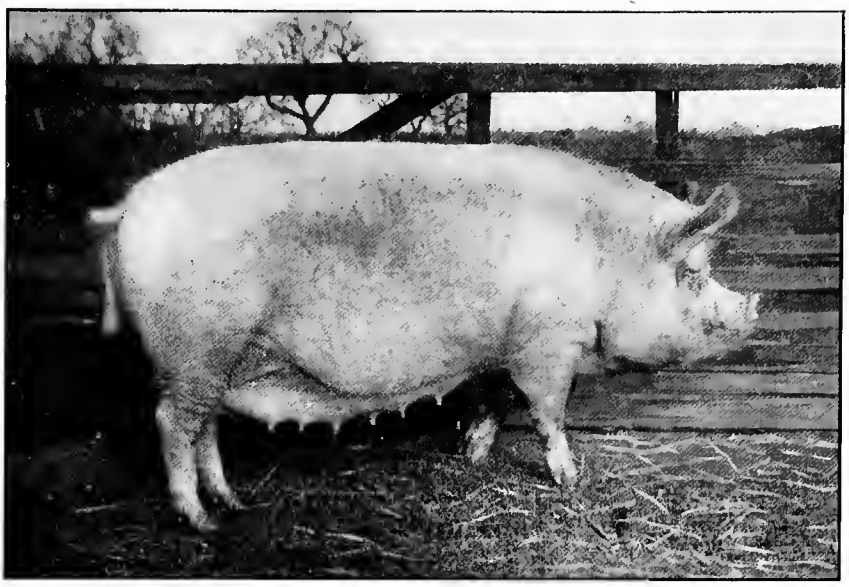
THE PROPERTY OF LAWTON MOORE, ESQ., BRAMPTON BRIAN, HEREFORDSHIRE.

ROSCOMMON RAM.

THE PROPERTY OF MATHEW FLANAGAN, ESQ., TOMONA, TULSK, CO. ROSCOMMON.

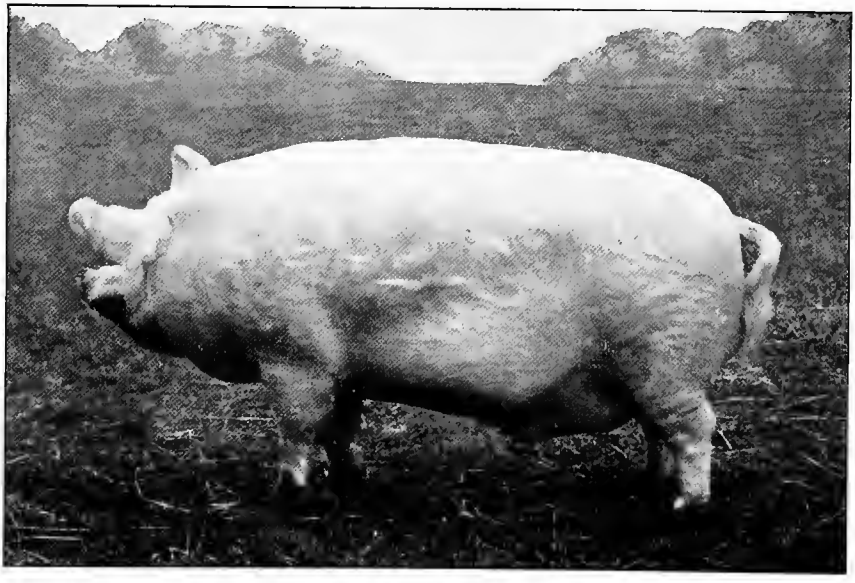
DERBYSHIRE GRITSTONE RAM.

THE PROPERTY OF WILLIAM TRUEMAN, ESQ., GOYTS BRIDGE, BUXTON.



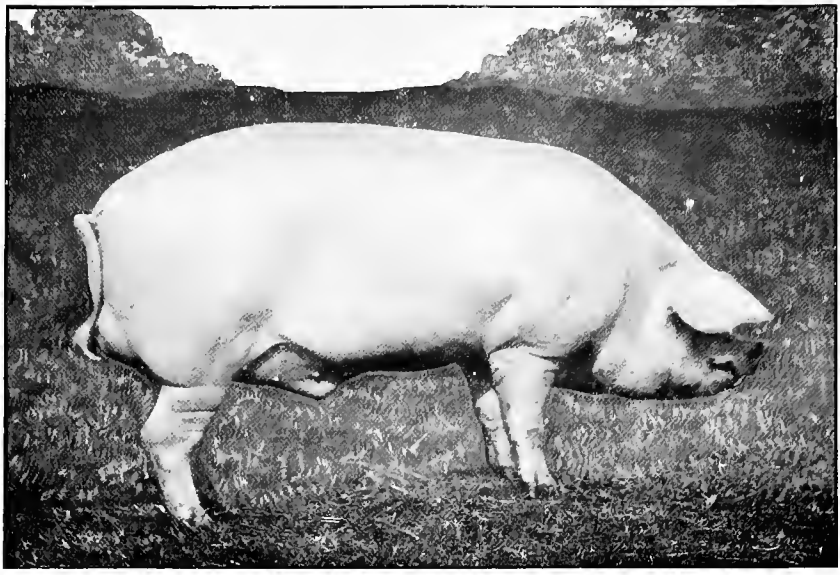
LARGE WHITE SOW.

THE PROPERTY OF SANDERS SPENCER, ESQ., ST IVES, HUNTS.



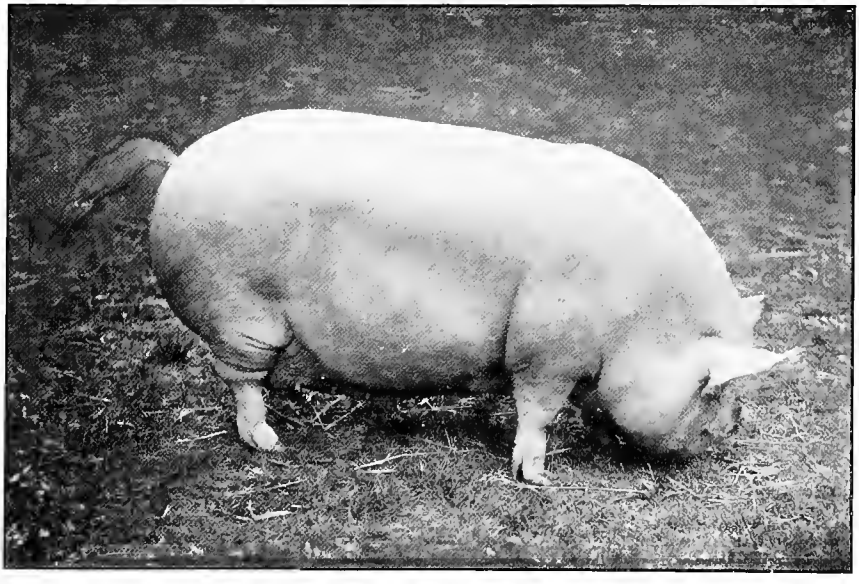
LARGE WHITE BOAR, "BROOMHOUSE HERCULES," 9031.

THE PROPERTY OF W. B. WALLACE, ESQ., BROOMHOUSE, CORSTORPHINE, EDINBURGH.



LARGE WHITE ULSTER BOAR.

THE PROPERTY OF J. CUNNINGHAM, ESQ., BELMOUNT, ANTRIM.



MIDDLE WHITE SOW.

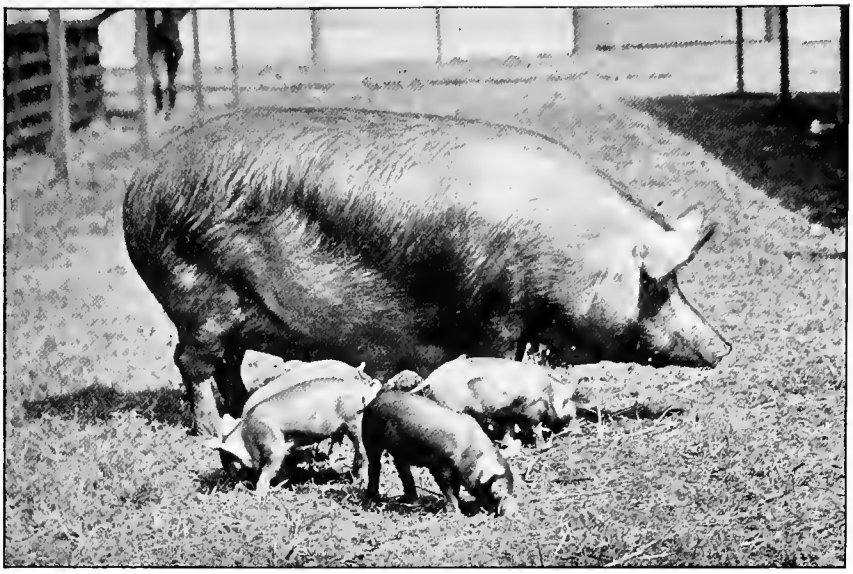
THE PROPERTY OF SIR GILBERT GREENALL, BART., WALTON HALL, WARRINGTON.

LARGE BLACK SOW, "BRENT DAME," 2355.

THE PROPERTY OF HENRY J. KINGWELL, ESQ., GREAT AISH, SOUTH BRENT, DEVON.

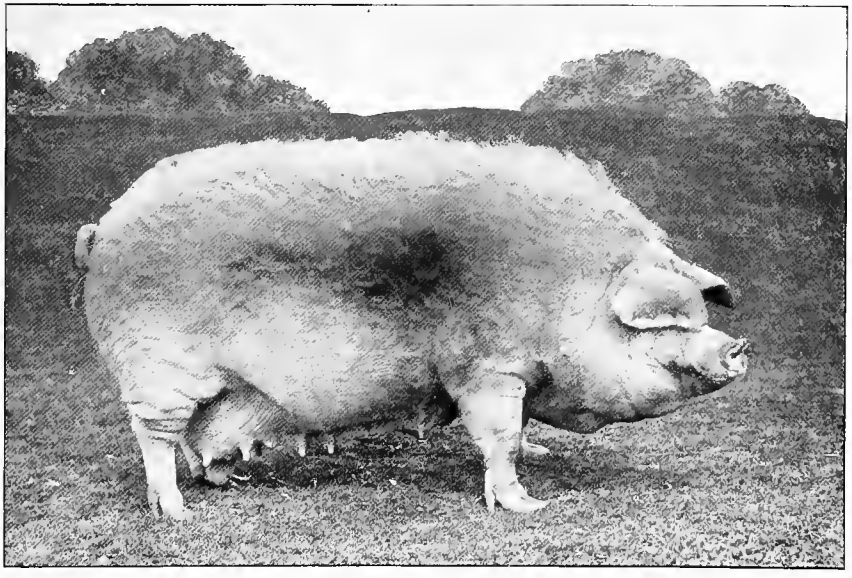
BERKSHIRE SOW, "PEEL EDITH."

THE PROPERTY OF J. JEFFERSTON, ESQ., PEEL HALL, CHESTER.



TAMWORTH SOW, "CHOLDERTON FAVOURITE."

THE PROPERTY OF H. C. STEPHENS, ESQ., OF CHOLDERTON, SALISBURY.



LINCOLN CURLY-COATED SOW.

THE PROPERTY OF HENRY CAUDWELL, ESQ., MIDVILLE, BOSTON, LINCOLNSHIRE.

INDEX TO VOLUMES I., II., III.

(DIVISIONS I. TO VI.)

	VOL.	PP.
Aberdeen-Angus cattle	iii.	62
As beef-producers	iii.	63
Characteristics of the breed	iii.	63
Early improvement	iii.	62
Management of herds	iii.	67
Points of the breed	iii.	66
Present position of the breed	iii.	66
Prices 1882-1907	iii.	65
Weights	iii.	65
Aberdeenshire manure experiments	ii.	51
Abortion	iii.	334
Among ewes	iii.	381
Board of Agriculture, inquiry into	iii.	337
Curative measures	iii.	339
Causes of	iii.	334
Epizootic	iii.	334
Ergot causing	iii.	334
Foot-rot and	iii.	381
Immunisation of animals	iii.	338
In mares	iii.	324
Methods of infection	iii.	338
Microbe of cattle	iii.	337
" of sheep	iii.	337
Preventing recurrence of	iii.	334
Preventive measures by Prof. Axe	iii.	381
Preventive treatment	iii.	335
Sporadic	iii.	334
Twin lambs and	iii.	381
Unripe roots and	iii.	381
Accident, insurance against	i.	280
"Acclimatisation" value of sheep	i.	279
Accounts	i.	244
Acidity in cheese-making	ii.	504
Acts of Parliament—		
Agricultural Holdings	i.	268, 273-277
Fertilisers and Feeding Stuffs	i.	506
Workmen's Compensation, 1906	i.	296
Administering medicine to stock	iii.	496
Adulteration of cakes	iii.	276
Advantages claimed for ensilage	ii.	293
After-birth	iii.	326
Aftermath	ii.	253, 254
Ages of store cattle	iii.	359
Agricultural bacteriology	i.	16
" botany	i.	14
Agricultural chemistry	i.	13
" locomotive	i.	419
" motors	i.	430
" pupils and their training	i.	1, 2, 3
" science, first degree in, in Britain	i.	31
" seasons, calendar and	ii.	62
" societies, agricultural education	i.	36
" " publications on drainage	i.	45
" year	ii.	57
" zoology	i.	15; ii. 424
Agricultural colleges in England	i.	32
Co-operation of county councils	i.	33
Courses of study	i.	32
Dairy schools	i.	32
Government grants	i.	33
Number of students at	i.	33
Standard of instruction	i.	32
Agricultural colleges in Scotland	i.	34
Courses of study	i.	34
Dairy education	i.	35
Extension work	i.	35
Grants to	i.	34
Progress of ten years	i.	35
Agricultural education	i.	30
Aid to, by agricultural societies	i.	36
At Cirencester College	i.	31
At Edinburgh University	i.	31
At Oxford	i.	32
Co-operation of county councils	i.	33
Demonstration and research	i.	35
Government grants for, and research	i.	39
Growing appreciation of	i.	35
Important sciences bearing on	i.	11
In Ireland	i.	36
Modern colleges in England and Wales	i.	32
N.D.A. Examinations	i.	36
N.D.D. Examinations	i.	36
Older teaching centres	i.	31
Tardy assistance from the State	i.	30
Agriculture—		
Application of steam-power to	i.	403
At Oxford	i.	32
Board of	i.	37
" and abortion	iii.	337

Agriculture—
Efficient drainage essential . . i. 44
Influence of electricity in . . ii. 404
Insects of importance to . . ii. 443
Irish Department of . . . i. 40
National Diploma Examinations in i. 36
Sciences applicable to . . . i. 9, 10
State aid . . . . . i. 37
Ailments of farm live stock . . iii. 435
Cattle . . . . . iii. 466
Horses . . . . . iii. 438
Index of subjects . . . . iii. 436
Among lambs and ewes . . iii. 380
Recipes . . . . . iii. 493
Sheep . . . . . iii. 484
Swine . . . . . iii. 490
Air, the . . . . . i. 22
Amount of, for perfect combustion i. 404
Carbonic acid and oxygen in . i. 49
Chemical composition of . . i. 23
Evils of impure, in stables . . i. 170
Utilisation of air-nitrogen by plants i. 332
Vitiation of, by animals . . i. 171
Weight of . . . . . i. 22
Air and germination . . . . ii. 155
" hot-, drying of grain . . . ii. 202
Air-grates, specification for . . i. 232
Aitken, Dr, on manuring potatoes . ii. 298
Albumen in milk . . . . ii. 480
Albuminoid ratios . . . . iii. 299
Alderney or Channel Island cattle . iii. 132
Alfalfa, seed of . . . . . ii. 76
Allan's drill dung-spreader . . i. 513
Alsike clover . . . . . ii. 75, 243
"Alta Vela" phosphates . . . i. 499
Alumins in soils . . . . . i. 304
American and Canadian silos . . ii. 290
" hay-collector . . . . ii. 267
" ploughs . . . . . i. 375
" reaping-machines . . . ii. 174
Ammonia—
Assimilation of, by plants . . i. 491
Fixing, in dung . . . . . i. 468
" in urine . . . . i. 476
In rain . . . . . i. 29
Preventing loss of, in liquid manure i. 485
Sulphate of . . . . . i. 490
Ammonium-salts better than nitrate of soda . . . . . ii. 11
Analysis of—
Bone-meal . . . . . i. 495
Cabbage . . . . . ii. 394
Carrots . . . . . ii. 394
Farmyard dung . . . . . i. 467
Grasses . . . . . iii. 286
Hops . . . . . ii. 383
Liquid-manure . . . . . i. 475
Pasture grass . . . . . ii. 394
Potatoes . . . . . ii. 394
Soil . . . . . i. 305
Town stable manure . . . i. 470
Turnips . . . . . ii. 394
Anatomy and physiology . . . i. 18
Ancient notions regarding beans . ii. 153
" reaping-machine . . . . ii. 172
" roads . . . . . i. 122
" threshing-machine . . . ii. 210
Anderson, Dr, on dung . . . i. 469
Aneroid . . . . . i. 23
Angle-iron gate . . . . . i. 119
Animals—
Ash constituents and nitrogen in 1000 lb. of various . . . i. 328
Barb-wire field-fences for . . i. 113
Classification of . . . . i. 16
Animals—
Composition of urine of different i. 475
Division of the Board of Agriculture i. 39
Energy value of foods to . . iii. 297
Fish products as food . . . iii. 290
Food requirements of . . . iii. 301
In relation to farm life . . ii. 424
Insects injurious to . . . iii. 417
Metabolism . . . . . iii. 296
Mites found on . . . . . iii. 429
Mutual dependence of plants and i. 14
Nutrition . . . . . iii. 291
Protection to timid . . . i. 154
Relation of geology to . . . i. 19
Vitiation of air by . . . i. 171
Water requirements of . . . iii. 296
Anthrax and imported food . . iii. 368
Apatite . . . . . i. 498
Apex, forming the, of stack . . ii. 197
Aphides, general treatment for . . ii. 444
Appliances, reaping . . . . ii. 169
" for bee-keeping . . . . iii. 259
Applied mechanics . . . . i. 22
Aqueous vapour . . . . . i. 27
Arab ponies . . . . . iii. 52
Arable and pastoral farming, steadings for . . . . . i. 132
" and sheep farming, barns for . i. 134
" farming, steading for . . . i. 135
" steadings for suburban farming . i. 149
" v. pasture rotation . . . i. 437
Arc, modes of describing . . . ii. 218
" specification for mill-wheel . . i. 238
"Arles" . . . . . i. 294
Aromatic herbs . . . . . ii. 404
Artificial drying of grain . . . ii. 202
" and special manures . . . i. 486
" manures, application of . . i. 515
" " classification of . . i. 486
Ascomycetes, the . . . . . ii. 411
Ash constituents and the seasons . ii. 13
" " importance of . . ii. 8, 9
" " and nitrogen in 1000 lb. of various animals i. 328
" quantity of, in an acre of wheat . ii. 95
Ash of—
Barley-straw . . . . . ii. 103
Bean- and pea-straw . . . ii. 148
Oat-straw . . . . . ii. 103
Rye-straw . . . . . ii. 103
Spent hops . . . . . ii. 384
Wheat-straw . . . . . ii. 102
Ashes from paring and burning land . i. 353
" of plants . . . . . i. 305
Ass and the Mule . . . . . iii. 59
" longevity of the . . . . iii. 60
" varieties of the . . . . iii. 59
Atholl ponies . . . . . iii. 50
Atmosphere, the . . . . . i. 22
Chemical composition of . . i. 23
Constituents of . . . . . i. 22
Gravity of . . . . . i. 23
Height of . . . . . i. 22
Nitrogen of . . . . . ii. 6
Pressure of . . . . . i. 22
Temperature of soil and . . i. 262
Atmospheric nitrogen for turnips . ii. 342
" influence on cream . . . ii. 490
Atmospherical complications in summer ii. 61
Autumn anomalies . . . . . ii. 65
" crops . . . . . ii. 66
" cultivation . . . . . ii. 65
" dunging for potatoes . . . ii. 301
" field-sports in . . . . ii. 65
" manured beans, sowing . . ii. 150

Autumn planting of potatoes . . ii. 308
" rain in . . . . . ii. 65
" rewards of labour . . . ii. 65
" sheep in . . . . . iii. 382
" sowing peas in . . . . ii. 154
" " wheat in . . . . ii. 117
" weather and field operations . ii. 65
" wheat . . . . . ii. 128
" and winter ploughing for turnips ii. 329
" and winter weather . . . ii. 13
Autumn-sown crops, drainage and . i. 50
Ayrshire cattle—
Beef production . . . . iii. 114
"Bowing" system . . . iii. 115
Early ideals . . . . . iii. 111
Historical . . . . . iii. 111
Management of herds . . . iii. 114
Milk records . . . . iii. 113
Milk yields . . . . . iii. 113
Points of the breed . . . iii. 111
Useful properties . . . . iii. 113

Back-band . . . . . i. 380
Bacteria—
Camembert and Brie . . . ii. 520
In plants . . . . . ii. 418
Rapid multiplication of . . i. 26
Soil . . . . . i. 311
Bacteriology, agricultural . . . i. 16
Badger, the . . . . . ii. 425
Bagging grain . . . . . ii. 228
" -machine . . . . . ii. 224
Baikie for binding cattle . . . i. 156
Bailiff, duties of . . . . . i. 6
Bale, ewung, *v.* travis partitions . i. 169
Band-knots, placing the . . . ii. 186
Bands and binding grain . . . ii. 184
Bank-vole . . . . . ii. 428
Barb-wire fences . . . . . i. 113
Bare fallow . . . . . i. 441
Barley—
After corn, experiments on . ii. 134
As food for stock . . . . iii. 270
Charlock . . . . . ii. 135
Classifying . . . . . ii. 96
Crop values . . . . . ii. 90
Effects of season on yield and quality ii. 21
Experiments at Rothamsted . ii. 19, 133
Experiments at Woburn . . ii. 43
Finishing sowing . . . . ii. 133
Germination of . . . . ii. 132
Grains in a bushel of . . . ii. 97
Harrowing for . . . . ii. 132
Hummellers . . . . . ii. 228
Judging . . . . . ii. 97
Limits of culture . . . . ii. 97
Malting . . . . . ii. 97
Manures for . . . . . ii. 37, 134
Manuring. See Rothamsted . ii. 19, 133
Meal . . . . . ii. 97
Oats and, mixed . . . . ii. 138
Quantity of seed . . . . ii. 132
Quick drying . . . . . ii. 187
Reaping . . . . . ii. 187
Riddle . . . . . ii. 225
After roots . . . . . ii. 134
Rothamsted experiments with . ii. 19, 133
Season and effect upon yield . ii. 21
Small sheaves . . . . ii. 187
Smut . . . . . ii. 416
Soil for . . . . . ii. 133
Sowing . . . . . ii. 131, 132
Summer culture of . . . ii. 135
Stack-heating . . . . ii. 200
Stage for cutting . . . . ii. 168
Barley—
Straw . . . . . ii. 103
Tillage for . . . . . ii. 131
Top-dressing . . . . ii. 136
Uses of . . . . . ii. 133
Utilisation of . . . . ii. 97
Varieties of . . . . . ii. 133
Weather and manures on . . ii. 22
Yield and weight of . . . ii. 90, 97
Yorkshire trials in manuring . ii. 135
Barn-brooms . . . . . ii. 227
" hay- . . . . . ii. 270
" hoe . . . . . ii. 226
" implements . . . ii. 225, 226
" owl, the . . . . . ii. 431
Barns—
And granaries . . . . i. 175
Conveying sheaves to sheaf- . i. 182
Corn . . . . . i. 180
English . . . . . i. 178
Granaries in connection with . i. 183
Granary window . . . . i. 183
Hay . . . . . i. 177
Preservation of wooden floors . i. 181
Straw . . . . . i. 178
Upper . . . . . i. 182
Vermin in . . . . . i. 183
Barometer—
Aneroid . . . . . i. 23
Upright . . . . . i. 23
Wheel . . . . . i. 23
Barrel churns . . . . . ii. 496
Barrels for early potatoes . . . ii. 315
Barrow, sack- . . . . . ii. 229, 230
Basic or "Thomas" slag . . . i. 500
Baskets, barn . . . . . ii. 226
" corn . . . . . ii. 227
" potato hand- . . . . ii. 306
" seed- . . . . . ii. 121
Bath cheese . . . . . ii. 514
Bathing or "pouring" sheep . . iii. 387
Bath-stool for sheep . . . . iii. 387
Beam, length of plough . . . i. 373
Beams, specification for . . . i. 238
Bean-riddle . . . . . ii. 226
Beans—
Aphis . . . . . ii. 444
Beetle . . . . . ii. 445
Botanical character of . . . ii. 153
Broadcast grown . . . . ii. 152
Consumption of . . . . ii. 147
Containing poison . . . ii. 147
Cropping . . . . . ii. 152
Cultivators and grubbers . . ii. 150
Field-bean . . . . . ii. 146
Food for stock . . . . iii. 273
Hand-hoeing . . . . ii. 152
Harrowing drills . . . . ii. 152
Harvesting . . . . . ii. 208
Horse-hoeing . . . . ii. 152
Locust or Carob . . . . iii. 278
Manures for . . . . ii. 38, 40, 149
Manures for turnips and . . ii. 33
And peas . . . . ii. 146, 398
And peas mixed . . . . ii. 153
And pea-straw, ash of . . . ii. 148
Ploughing for . . . . ii. 150
Poisonous . . . . . iii. 274
Preparing as food . . . iii. 274
Quantity of seed for . . . ii. 149
Riddle . . . . . ii. 226
Rows on the flat . . . . ii. 152
Rust in . . . . . ii. 415
Sowing . . . . . ii. 148, 150, 151
Soy . . . . . iii. 274

Beans—
Spring tillage for . . . . ii. 150
Stacking . . . . . ii. 209
Summer culture of . . . ii. 152
Thatching . . . . . ii. 209
Varieties of . . . . . ii. 149
Vegetable casein in . . . iii. 273
Weevils . . . . . ii. 459
Wheat after . . . . . ii. 119
Yield and weight of . . . ii. 147
Bearing-reins . . . . . i. 379
Beds, box-, in family cottages . . i. 208
Bee-keeping . . . . . iii. 257
Appliances . . . . . iii. 259
Clover for bees . . . . iii. 257
As a farm industry . . . iii. 257
Hives . . . . . iii. 258
Management . . . . . iii. 260
Marketing honey . . . . iii. 258
Principles of . . . . . iii. 257
Beet carrion beetle . . . . ii. 445
" fly . . . . . ii. 446
" augar- . . . . . ii. 403
Beetles—
Bean . . . . . ii. 445
Beet carrion . . . . . ii. 445
Brassy-flea . . . . . ii. 458
Cabbage-flea . . . . . ii. 448
Click . . . . . ii. 454
Colorado . . . . . ii. 461
Corn ground- . . . . . ii. 455
Devouring slugs and snails . . ii. 474
Flour . . . . . ii. 456
Ground . . . . . ii. 469
" and strawberries . . ii. 467
Mangold . . . . . ii. 446
Pea . . . . . ii. 445
Raspberry . . . . . ii. 467
Rose . . . . . ii. 469
Turnip-fly or flea- . . . . ii. 463
" mud- . . . . . ii. 462
Useful . . . . . ii. 469
Beetroot . . . . . ii. 398
" pulp . . . . . iii. 281
Bell's reaping-machine . . . ii. 172
Bere and rye as food for stock . . iii. 271
Berkshire pig . . . . . iii. 213
Biestinga, composition of . . . iii. 351
Binder, self- . . . . . ii. 177
Binding . . . . . ii. 178
Cost of cutting with . . . ii. 181
Efficiency of the . . . . ii. 177
General construction . . . ii. 177
Hands required . . . . ii. 181
Raking . . . . . ii. 181
Saving in crop . . . . ii. 181
Size of sheaves . . . . ii. 181
Speed in cutting round . . ii. 181
Binding cattle . . . . . i. 156
" grain . . . . . ii. 184
" horses . . . . . i. 174
" method of . . . . . ii. 184
" position of the band . . ii. 185
Biology . . . . . i. 13
Biped pass . . . . . i. 121
Birds devouring slugs and snails . . ii. 474
" protection against disbudding by ii. 439
" in relation to the farm . . ii. 431
" in spring storms . . . . ii. 59
Bisset's binder . . . . . ii. 180
Black grass, seed of . . . . ii. 83
Blackbird, the . . . . . ii. 436
Blackface sheep—
Characteristics . . . . iii. 183
Distribution of the breed . . iii. 183
Blackface sheep—
Early history . . . . . iii. 183
Management . . . . . iii. 185
Prices of (1893-1907) . . . iii. 184
Prices of wool (1893-1907) . . iii. 184
Ram-breeding . . . . . iii. 186
A typical sheep . . . . . iii. 184
Qualifications of a shepherd . iii. 185
In winter . . . . . iii. 396
Blending, house for butter- . . ii. 522
Blood, dried . . . . . i. 488
"Blood" horse . . . . . iii. 34
Blood-sucking lice . . . . . iii. 425
Blue-bottles or meat flies . . . iii. 423
Blunt's ensilage press . . . . ii. 292
Board of Agriculture and Fisheries . i. 37
" " and abortion . iii. 337
Boarding in the kitchen . . . i. 227
Boilers . . . . . i. 407
Bolls, flax-seed . . . . . ii. 389
Bondon or Neufchatel cheese . . ii. 521
Bone and mineral phosphate . . i. 502
Bone manure . . . . . i. 493
Bone-meal, analyses of . . . i. 495
Bones . . . . . i. 493
Burned . . . . . i. 495
Dissolved, and "bone compounds" i. 495, 496
Fermented . . . . . i. 494
Raw . . . . . i. 493
Steamed or degelatinised . . i. 494
Boning-rod for drains . . . . i. 67
Book-keeping . . . . . i. 244
Bordeaux mixture for spraying . . ii. 409
Border Leicester sheep—
Characteristics . . . . iii. 143
Early improvers . . . . iii. 141
Management in flocks . . . iii. 144
Mertoun flock . . . . iii. 142
Origin—Bakewell's improvements iii. 141
Noted breeders . . . . iii. 143
Preparing rams for sale . . iii. 147
Value for crossing . . . iii. 144
"Boases," stack "kilns" or . . ii. 265
" for stacking hay . . . ii. 271
" for ventilating stacks . . ii. 201
Botanical character of beans . . ii. 153
Botany—
Natural Orders of plants . . i. 14
Plant pathology . . . . i. 14
Bot-flies . . . . . iii. 418
Bothies . . . . . i. 226
Bothy system . . . . . i. 227
Bottles, milk . . . . ii. 482, 485
Boulder-clay . . . . . i. 18
Boundary fences . . . . . i. 86
Box-beds in family cottages . . i. 208
Boxes—
For butter . . . . . ii. 501
For cattle . . . . . i. 155
For horses . . . . . i. 174
Boxing seed potatoes . . . . ii. 308
Bracken clock or garden chafer . . ii. 455
Bracken-cutting . . . . . i. 343
Brackets, specification for . . . i. 238
Bran as food for stock . . . iii. 270
Break-furrowing . . . . . ii. 332
Breast method of water-wheel . . ii. 220
Breasting bank-and-ditch hedges . i. 97
" knife . . . . . i. 96
Breeding—
Controlling sex . . . . iii. 227
Cross- . . . . . iii. 228
Grading . . . . . iii. 228
Heredity . . . . . iii. 225
Horses . . . . . iii. 315

Breeding—
In-and-in . . . . . iii. 229
Line- . . . . . iii. 229
Mendel's laws in stock- . . . iii. 231
Mental impression . . . . iii. 227
Mule . . . . . iii. 60
Principles of stock- . . . . iii. 224
Selection in . . . . . iii. 228
Stock, treacle for . . . . iii. 278
Systems of . . . . . iii. 228
Telegony . . . . . iii. 227
Transmission of acquired characters iii. 227
Variations in results . . . iii. 225
Breeds of—
Cattle . . . . . iii. 3, 62
Dogs . . . . . iii. 264
Horses . . . . . iii. 2, 9
Poultry . . . . . iii. 237
Sheep . . . . . iii. 7, 138
Swine . . . . . iii. 8, 210
Bressay stud of Shetland ponies . . iii. 56
Brewers' grains for dairy cows . . iii. 272
" difference in composition . iii. 272
" and distillers' grains as food iii. 271
" dried grains . . . . iii. 271
" dried *v.* wet grains . . iii. 272
Bricks, specification for . . . i. 231
Bridges for sheep . . . . iii. 403
Bridle, horse . . . . . i. 379
Brie cheese . . . . . ii. 520
Britain, rainfall in Great . . . i. 29
British cattle, modern . . . . iii. 6
" resources for corn production . ii. 90
" wool . . . . . iii. 404
Broadcast manure-distributor . . i. 520
" sowers . . . . ii. 123
" " hand . . . ii. 124
" sowing, disadvantages of . ii. 157
" " of turnips . . ii. 335
Broccoli as food . . . . . iii. 282
Brome, seed of rye and soft . . ii. 86
Brood mares, care of . . . . iii. 325
Brooms, barn . . . . . ii. 227
Bucket water-wheel . . . . ii. 217
Buckwheat . . . . . ii. 376
" as food for stock . . . iii. 272
" reaping . . . . . ii. 209
" seed of . . . . . ii. 78
Bug, harvest . . . . . iii. 428
Building dry-stone walls . . . i. 105
" process of stack- . . . ii. 193
Buildings—
Farm. See Farm buildings . . i. 126
Iron . . . . . i. 228
Specifications for farm . . . i. 229
Bulb-eating slug . . . . . ii. 474
Bulbous plants . . . . . ii. 401
Bullfinch, the . . . . . ii. 439
Bulling of cows . . . . . iii. 333
Bullock-holder . . . . . iii. 333
Bulls, treacle for young . . . iii. 278
Bunt of wheat . . . . . ii. 416
Buntings . . . . . ii. 438
Burning heather . . . . . i. 343
" lime . . . . . i. 363
" paring and, land . . . i. 349
"Burnt ale" . . . . . iii. 272
Bush fruit . . . . . ii. 400
Butter, working of . . . . . ii. 499
Butter-worker . . . . . ii. 500
" and churn . . ii. 498
Centrifugal butter-drier . . ii. 500
Fresh butter . . . . ii. 501
Packing into crocks . . . ii. 501
Salting butter . . . . ii. 500
Butter—
Scotch hands . . . . . ii. 501
Yield of . . . . . ii. 478
Butter-blending house . . . . ii. 522
" -dairy ground-plan . . . i. 148
" -drier, centrifugal . . . ii. 500
" -fat . . . . . ii. 478
Buttercups, seeds of . . . . . ii. 77
Butterflies, cabbage . . . . . ii. 446
Butter-making . . . . . ii. 493
Boxes for transit . . . . . ii. 501
And cheese-making associated . ii. 522
Churns . . . . . ii. 496
Churning . . . . . ii. 498
Sleepy cream . . . . ii. 499
Speed of the churn . . ii. 499
Time of . . . . ii. 494, 499
Whole-milk . . . . ii. 495
Colouring butter . . . . . ii. 501
Effect of food on the temperature . ii. 495
Influence of salt . . . . . ii. 494
Ripening cream . . . ii. 493, 494
Starter jelly . . . . . ii. 493
Sweet-cream butter . . . . ii. 494
Temperature for churning . . ii. 494
Use of a "starter" . . . . ii. 493
Byre-fittings, specification for . . i. 239
Byres—
And courts, drainage of . . i. 158
Binding cattle . . . . i. 156
Flooring of . . . . . i. 156
For feeding cattle . . . i. 158
Mangers in . . . . . i. 155
Temperature of, and milk-yield . iii. 346
Ventilation of . . . . i. 157
Windows in . . . . . i. 157

Cabbages . . . . . ii. 371
Analysis of . . . . . ii. 394
Aphis . . . . . ii. 449
Black-rot of . . . . . ii. 418
Butterflies . . . . . ii. 446
Flea-beetle . . . . . ii. 448
As food . . . . . iii. 282
Gall-weevil . . . . . ii. 463
Growing of . . . . . ii. 393
And Italian rye-grass . . . ii. 372
Lifting . . . . . ii. 373
Manuring . . . . . ii. 372
Moth . . . . . ii. 447
Produce . . . . . ii. 372
Root fly . . . . . ii. 447
Root gall-weevil . . . . ii. 448
Seed of . . . . . ii. 73
Sowing and planting . . . ii. 371
Storing . . . . . ii. 373
For spring use . . . . ii. 371
For summer use . . . . ii. 371
Utilising . . . . . ii. 372
" stalks . . . . . ii. 373
Yield of . . . . . ii. 372
Cadzow Park wild white cattle . . iii. 4
Caerphilly cheese . . . . . ii. 514
Cake-feeding on pastures . . . ii. 282
Cake and meals, compound . . . iii. 287
Cakes for store cattle . . . . iii. 361
Calcium cyanamide . . . . . i. 489
" oxide of . . . . . i. 360
Calendar and agricultural seasons . ii. 62
Calf-rearing . . . . . iii. 348, 374
Allowances of other foods . . iii. 353
Artificial food . . . . iii. 352
Aversion of farmers to . . . iii. 348
Breed longer from cows . . iii. 349
Breeding from heifers . . . iii. 349

Calf-rearing—
Calf-crib . . . . . iii. 351
Calf's first food . . . . . iii. 351
Are calves nuisances? . . . iii. 350
Care in letting out calves . . iii. 351
Castrating . . . . . iii. 354
Composition of biestings . . iii. 351
Danger of gorging calves . . iii. 354
Deficiency of store cattle . . iii. 349
Feeding calves . . . . . iii. 351
" calves for veal . . iii. 353
Home breeding, not importation, the remedy . . . . iii. 349
Housing calves . . . . . iii. 350
On large farms . . . . . iii. 349
Milk substitutes . . . . . iii. 350
North of England rations . . iii. 353
In ordinary mixed-bred herds . iii. 352
Preparing food for calves . . iii. 353
Prevalent methods . . . . iii. 352
In pure-bred herds . . . . iii. 352
Quantities of milk for calves . iii. 353
Rear more calves . . . . . iii. 349
Rearing or selling calves . . iii. 350
Reform in calf-feeding . . iii. 351
Separated milk for calves . . iii. 352
Setoning . . . . . iii. 354
Suckling and hand-rearing . . iii. 352
Weaning calves . . . . . iii. 354
Calves—
Castration of . . . . . iii. 498
Exercise and handling for showing iii. 375
Linseed for . . . . . iii. 275
Management of . . . . . iii. 330
Milk for . . . . . ii. 486
Palm-nut meal as food for . . iii. 277
Salt and chalk for . . . . iii. 375
Calving—
Abortion . . . . . iii. 334
Attendance in . . . . . iii. 331
The calf . . . . . iii. 332
Coming in "Season" . . . . iii. 333
Extracting a dead calf . . . iii. 332
Feeding in-calf cows . . . . iii. 331
Gestation . . . . . iii. 331
Immediate milking of cow . . iii. 333
Licking and rubbing calves beneficial iii. 333
Navel-string . . . . . iii. 332
Prelapse of the vagina . . . iii. 331
Preparation for . . . . . iii. 331
Reckoning time of . . . . iii. 331
Refreshing the cow . . . . iii. 333
Reviving calves . . . . . iii. 332
Season of . . . . . iii. 330
Symptoms of . . . . . iii. 331
" of pregnancy . . . . iii. 330
Cambridge road-scrapings . . . i. 497
Camembert cheese . . . . . ii. 520
Canadian and American silos . . ii. 290
Candlemas entry to farms . . . i. 277
Cantal cheese . . . . . ii. 519
Capillary power of soils . . . i. 309
Capital per acre in stocking farms i. 285, 287
Carbonic acid and oxygen in the air . i. 49
Carcase competitions . . . . iii. 412
Carnivora . . . . . ii. 424
Carob beans . . . . . iii. 278
Carpenter work . . . . i. 232, 238, 242
Carriage harrows . . . . . ii. 249
Carrick cattle. See Galloway . . iii. 71
Carrion crow . . . . . ii. 432
Carrots . . . . . ii. 393, 398
Analysis of . . . . . ii. 394
Fly . . . . . ii. 445
Growing and heating in pits . ii. 396
Carrots—
For horses . . . . . iii. 282, 319
Leaves of . . . . . ii. 396
Liability to rot . . . . . ii. 395
Pests . . . . . ii. 396
Pits . . . . . ii. 396
Preparing seed . . . . . ii. 395
Produce . . . . . ii. 395
Pulling . . . . . ii. 396
And rye . . . . . ii. 395
Seed of . . . . . ii. 81
Soil for . . . . . ii. 394
Sowing . . . . . ii. 394
Storing . . . . . ii. 395
Thinning . . . . . ii. 395
Tillage and manuring . . . ii. 394
Time of storing . . . . . ii. 396
Tops as food for stock . . ii. 393, iii. 282
Varieties of . . . . . ii. 395
Wireworms . . . . . ii. 453
Carse-land farming . . . . . i. 5
Steadings for . . . . . i. 136
Cart—
Farm tip- . . . . . ii. 349
Frames . . . . . ii. 190
Harvest . . . . . ii. 190
Jack's farm . . . . . ii. 318
Liquid-manure . . . . . i. 483
Loading a . . . . . ii. 192
Ropes . . . . . ii. 191
Roping a loaded . . . . ii. 192
Carting "gaitins" . . . . . ii. 192
" hours of . . . . . ii. 192
Casein in milk . . . . . ii. 479
" vegetable, in beans . . . iii. 273
Cash-book . . . . . i. 248
Castration of calves . . . iii. 354, 498
" of horses . . . . . iii. 497
" of lambs . . . . . iii. 379, 498
" of pigs . . . . . iii. 498
Cat, wild . . . . . ii. 425
Catch-cropping bush fruit . . . ii. 400
Caterpillars, surface . . . . ii. 465
Cattail, seed of . . . . . ii. 84
Cattle—
Abortion, microbe of . . . iii. 337
Administering medicine to . . iii. 496
Advantages in home-grown food . iii. 359
Age for fattening . . . . iii. 364
Ages of store . . . . . iii. 359
Ailments of . . . . . iii. 466
Albuminoid ratio . . . . iii. 372
Anthrax and imported food . . iii. 368
Apportioning home-grown foods . iii. 358
Attention to animals' feet . . iii. 376
Balancing food properly . . iii. 365
Barb-wire field-fences for . . i. 113
Binding . . . . . i. 156
Boxes and stalls for . . . i. 155
" plans for . . . . i. 139
Bruising grain for . . . . iii. 357
Byres for feeding . . . . i. 158
Carcase competitions . . . . iii. 412
Care in beginning winter feeding . iii. 359
Changing stock on pastures . . iii. 363
Cheaper meat from young . . iii. 364
Concentrated food on pastures . iii. 370
Cooking or steaming food . . iii. 356
Courts for . . . . . iii. 358
Cutting turnips . . . . . iii. 355
Daily allowance of cake and grain iii. 366
Daily allowance of turnips . . iii. 365
Diagram of side of beef . . iii. 414
Different kinds of roots for store . iii. 360
Digestible albuminoids . . iii. 372

Cattle—
Digestible matter per lb. of increase iii. 372
Early maturity iii. 363
Economical rearing of iii. 357
Economise turnips iii. 359
Equipment of houses for i. 151
Experimente with iii. 294
Fattening, in winter iii. 363
Feed sparingly and frequently iii. 360
Feeding in Aberdeenshire iii. 366
" in Easter Ross iii. 367
" in England iii. 368
" in Ireland iii. 370
Foods to be bought and sold iii. 359
Form and constitution iii. 374
Fresh air for iii. 357
Frozen roots iii. 355
Give the pasture a good start iii. 362
Good breeding essential iii. 374
Grooming iii. 376
Hours of iii. 360, 365
Houses for i. 130
Houses for, in cold districts iii. 358
Housing calves iii. 375
Importance of practical experience in feeding iii. 376
Improvement in show stock iii. 373
Increase of live-weight iii. 372
Increasing food with advancing age iii. 376
Influence of age on feeding iii. 372
Keep stock progressing iii. 362
Lawes on high-pressure and profitable feeding iii. 364
Leguminous fodders for iii. 373
Loss from exposure iii. 357
M'Combie's system of feeding iii. 366
Management of store and fattening iii. 355
Methods of fattening iii. 364
Mixed feeding cakes iii. 375
Oatmeal balls for iii. 369
Overgrowth of pastures injurious to iii. 362
On pastures iii. 370
Pastoral farming i. 130
Period of gestation iii. 236
Potatoes for iii. 369
Preparation of food for iii. 355
Preparing for shows iii. 373
Price per live cwt. of iii. 411
Proper age for showing iii. 374
Pulped food for store iii. 361
Pulping roots iii. 355
Pulping system for feeding iii. 366
Rations for fattening iii. 365
Recipes for ailments of iii. 495
Review of feeding experiments (1832-1909) iii. 371
Scotch "blend" of food iii. 368
Scottish feeding customs iii. 365
Selecting show stock iii. 374
Selling fat, in spring ii. 59
" " in summer ii. 63
Sheds in southern districts iii. 358
Shelter for iii. 357
"Soiling" iii. 370
Southern systeme of feeding store iii. 361
Store, deficiency of iii. 349
" on pastures iii. 362
" thriving best in open courts i. 167
Study the animal's appetite iii. 360
Temperament iii. 374
Troughs i. 151
Turnips and cake for breakfast? iii. 366
Turnips and straw for store iii. 360
Use of condiments iii. 376

Cattle—
Value of potatoes for iii. 282
Washing roots for iii. 355
What food is to be used iii. 364
Winter feeding on fields iii. 370
" feeding of store iii. 358
" housing of store iii. 357
Wire fence for i. 115
Without roots iii. 369
Cattle, breeds of— iii. 3, 62
Aberdeen-Angus iii. 62
Ayrshire iii. 111
Devon iii. 101
Dexter-Shorthorn iii. 135
Foreign breeds of iii. 137
Galloway iii. 71
Guernsey iii. 132
Hereford iii. 97
Highland iii. 116
Jersey iii. 129
Kerry and Dexter iii. 125
Lincolnshire Red Shorthorn iii. 94
Long-horned iii. 136
Modern British iii. 6
Orkney and Shetland iii. 136
Polled Durhams iii. 137
Polled Hersfords iii. 137
Red Polled iii. 78
Shorthorn iii. 82
South Devon iii. 105
Sussex iii. 108
Welsh black iii. 121
Wild white iii. 4
Other wild white herds iii. 6
Cattle-courts i. 161
Advantages of covered i. 161
Comparative cost and return i. 165
Construction of i. 163
Covered-court *v.* open-court dung i. 162
Covered, manure for potatoes i. 166
Drain grating for i. 159
Drainage of i. 163
Economy of food i. 162
Fermentation in the dung i. 166
How litter should be spread in i. 457
Increased value of manure i. 161
Preventing "fire-fang" in manure i. 166
Recapitulation i. 167
Roofing i. 163
Total saving by using i. 163
Water-supply to i. 152
Cattleman, duties of i. 8
Cauliflowers ii. 398
Causeway, specification for i. 237, 242
Celery fly ii. 449
Celtic pony iii. 54
Centigrade scale i. 26
Centrifugal butter-drier ii. 500
" separator ii. 491
Cereal crops with grass seeds ii. 250
" " insects injurious to ii. 449
Cereals, manures for ii. 7, 34, 40
" sowing ii. 115
" stacking ii. 189
Cesspools i. 71
" specification for i. 230, 237
Chaff as a foot-warmer ii. 103
Chaff straw-, as food iii. 287
Chaffinch, the ii. 438
Chaffing litter i. 457
Chalk, salt and, for calves iii. 375
Chalking land i. 348
Chalky soils i. 299
Challoner's level for drains i. 67
Chamomile, seed of ii. 79

Channel Island cattle . . . iii. 129
Charlock, destroying . . . ii. 135
„ seed of . . . . . ii. 73
Charring posts for field fences . . i. 112
Chart for drains . . . . . i. 70
"Chaser" (or "rig") lamb . . . iii. 380
Cheddar cheese . . . . . ii. 506
Character and composition . . ii. 506
Chessets or cheese-mould . . ii. 510
Colouring . . . . . ii. 508
Curd-breaker and knives . . ii. 508
Curing . . . . . ii. 510
Process of making . . . ii. 507
Salting . . . . . ii. 509
Scale of points . . . . ii. 507
Testing acidity of curd . . ii. 509
„ „ of milk . . ii. 507
Treatment of the milk . . . ii. 507
Cheese-making . . . . . ii. 501
Acidity . . . . . ii. 504
„ controlling the . . ii. 505
„ measuring the . . ii. 506
Apartments for . . . . ii. 502
Bath cheese . . . . . ii. 520
Brie cheese . . . . . ii. 520
And butter-making associated . ii. 522
Caerphilly cheese . . . . ii. 514
Camembert cheese . . . . ii. 520
Cantal cheese . . . . . ii. 519
Cheddar cheese . . . . . ii. 506
Cheshire cheese . . . . . ii. 511
Culture-starters . . . . . ii. 505
Curd-mill . . . . . ii. 502
Derbyshire cheese . . . . ii. 512
Dutch cheeses . . . . . ii. 516
Edam cheese . . . . . ii. 516
English soft cheeses . . . . ii. 513
Foreign cheeses suitable for Britain ii. 515
Gloucester cheese . . . . ii. 513
Gorgonzola cheese . . . . ii. 518
Gouda cheese . . . . . ii. 517
Gruyère . . . . . ii. 516
Lancashire cheese . . . . ii. 513
Leicestershire and Derbyshire cheese ii. 512
Neufchatel or Bondon cheese . ii. 521
Parmesan or Grana cheese . . ii. 517
Pont l'Evêque . . . . . ii. 521
Presses . . . . . ii. 503
Propagation of a culture-starter . ii. 505
Racks for ripening . . . . ii. 502
Rennet . . . . . ii. 503
Ripening . . . . . ii. 504
Roquefort cheese . . . . . ii. 519
Skim-milk cheese . . . . . ii. 510
"Starters" . . . . . ii. 504
Stilton cheese . . . . . ii. 510
Utensils . . . . . ii. 502
Vat . . . . . ii. 502
Yorkshire cheese, "Cotherstone" and "Wensleydale" . . . ii. 513
Cheese-room of farmhouse . . . i. 191
Chemical analysis of soil essential . i. 307
„ changes in the soil . . . i. 303
„ composition of the air . . i. 23
„ elements important to farmers . i. 12
„ processes in mixing manures . i. 508
„ substances in soil . . . i. 302
Chemist, the, first in demand . . i. 11
Chemistry—
Agricultural . . . . . i. 13
General . . . . . i. 11, 13
Inorganic . . . . . i. 13
Organic . . . . . i. 13
Prominence given to . . . i. 10
What a farmer should know of . i. 12
Cheshire cheese . . . . . ii. 511
Cheeset for cheese . . . . ii. 510
Cheviot sheep—
Characteristics . . . . iii. 190
Early improvement . . . iii. 190
Improvere of . . . . iii. 191
Management of . . . . iii. 192
Chicory . . . . . ii. 404
„ seed of . . . . . ii. 80
Chickweed, seed of . . . . ii. 74
„ family, kidney-shaped seeds of the ii. 73
Chillingham Park wild white cattle . iii. 5
Chough, the . . . . . ii. 434
Churning whole-milk . . . . ii. 495
Churns . . . . . ii. 496
Combined, and butter-worker . ii. 498
Important features of . . ii. 498
Railway milk, or can . . . ii. 485
Types of . . . . . ii. 496
Cirencester College of Agriculture . i. 31
Cistern, water- . . . . . i. 153
Civil engineering . . . . . i. 22
Classification of animals . . . i. 16
„ of farm seeds . . . . ii. 72
„ of insects . . . . . ii. 443
„ of soils . . . . . i. 301
„ of wools . . . . . iii. 405
Clay soil . . . . . i. 298
Clay-cutters . . . . . i. 64, 65
Clay-land drained . . . . i. 50
„ not to be ploughed wet . i. 398
„ wet . . . . . i. 50
Claying lands . . . . . i. 346
Is claying injurious to sheep? . i. 348
Mixing soils . . . . . i. 348
Clay's grubber . . . . . ii. 330
Cleavers, seed of . . . . . ii. 81
Cleveland bay horse—
Characteristics . . . . iii. 33
Management . . . . . iii. 34
Value for crossing . . . iii. 33
Click beetles . . . . . ii. 454
Clifton Park system of growing grass . ii. 287
Climate . . . . . i. 261-264
„ effect of, on pastures . . ii. 280
„ elevation and local . . i. 263
„ and irrigation . . . i. 356
„ local . . . . . i. 263
„ „ and land value . . i. 264
„ and rotation . . . i. 437
„ soil, and manuring . . i. 518
„ soils and, for clovers . . ii. 241
„ what constitutes . . i. 261
Clip-fork . . . . . ii. 274
Clippers, horse- . . . . . iii. 324
Clipping horses . . . . . iii. 323
„ sheep . . . . . iii. 384
Clod-crushers . . . . . ii. 385
Clotted cream, Devonshire . . . ii. 492
Clover. See also Grasses . . . ii. 230
Alsike . . . . . ii. 75, 243
Creeping trefoil . . . . ii. 243
Crop *v.* bare fallow . . . i. 442
Culture in England . . . ii. 375
Cutting . . . . . ii. 255
Dodder . . . . . ii. 423
„ seed of . . . . ii. 89
Experiments with . . . ii. 49
Extra late variety . . . ii. 376
Feeding value of . . . . iii. 284
As a forage crop . . . . ii. 375
Frost injuring, seeds . . . ii. 250
Grasses and . . . . . ii. 230
„ for permanent pasture ii. 245, 285
And grasses as food . . . iii. 284

Clover—
And grasses, composition of . iii. 284
Importance of . . . . ii. 241
Impurities in . . . . ii. 244
Late variety of crimson . . ii. 375
Meadow trefoil . . . . ii. 243
Perennial red . . . . ii. 74, 242
Rape, seed of . . . . ii. 89
Seed . . . . . ii. 241
Sickness, contributing cause of . ii. 471
Soils and climate for . . . ii. 241
Sowing crimson . . . . ii. 375
Suckling, seed of . . . . ii. 76
Tedders injuring, hay . . . ii. 260
Trefoil or yellow . . . . ii. 76, 244
Trifolium incarnatum . . ii. 243, 375
Turning, hay . . . . ii. 261
Varieties of . . . . ii. 241
White . . . . . ii. 75, 243
" variety . . . . ii. 376
Yellow suckling, seed of . . ii. 76
Club-root, or "finger-and-toe" . ii. 417
Clun sheep . . . . . iii. 203
Clydesdale horse—
Admission to Stud Book . . iii. 20
Ancient types . . . . iii. 21
Characteristics . . . . iii. 21
Early improvement . . . iii. 16
Features of the modern . . iii. 23
Infusion of Shire blood . . iii. 20
Management of Show stock . iii. 28
Management of studs . . . iii. 25
Markets for . . . . . iii. 23
Measurements of . . . . iii. 22
Origin . . . . . iii. 16
Sales from 1876 to 1908 . . iii. 24
Society . . . . . iii. 20
Spreading of the breed . . iii. 18
Thompson's black horse . . iii. 17
Coal as fuel . . . . . i. 404
Cockchafer . . . . . ii. 455
"Cocking" hay . . . . . ii. 261
Cocksfoot, seed of . . . . ii. 87
Cocoa-nut cake as food . . . iii. 277
Coiling hay . . . . . ii. 262
"Coling" . . . . . ii. 189
Collar, horse . . . . . i. 379
Collectors, hay . . . . . ii. 265
Colleges. See Agricultural colleges . i. 31
Collie Dogs . . . . . iii. 264
Collier in beans (aphis) . . . ii. 444
Colorado beetle . . . . . ii. 461
Combustion—
Amount of air for perfect . . i. 404
Engine, internal . . . . i. 21
Oxygen . . . . . i. 404
Comfrey, prickly . . . . . ii. 376
" " as a forage crop . iii. 289
"Common" farming . . . . i. 5
Compact pastoral steading . . i. 131
Compensation for disturbance . i. 268
" for improvements . . i. 276
" Workmen's, Act, 1906 . i. 296
Composite cottages . . . . i. 223
Composites, "seeds" of . . . ii. 79
Composition of—
Air . . . . . i. 23
Basic slag . . . . . i. 500
Biestings . . . . . iii. 351
Clay and shell marls . . . i. 349
Common foods . . . . iii. 290
Coprolites . . . . . i. 498
Crops in pounds per acre . . i. 326
Dung . . . . . i. 467
Earth's crust . . . . . i. 306
Composition of—
Grasses . . . . . iii. 284
Guanos . . . . . i. 487
Lime . . . . . i. 366
Limestone . . . . . i. 365
Milk from different breeds of cows ii. 478
Oatmeal . . . . . ii. 100
Phosphate of Lime . . . i. 501
Phosphorite . . . . . i. 498
Seeds . . . . . ii. 156
Separated milk . . . . iii. 352
Sheep dips . . . . . iii. 389
Slaked lime . . . . . i. 364
Superphosphates . . . . i. 502
Turnips . . . . . iii. 279
Urine of different animals . . i. 475
Compost . . . . . i. 366
" with liquid manure . . . i. 484
Compound cake and meals . . . iii. 287
" engines . . . . . i. 413
" manures . . . . . i. 505
Concrete floors . . . . i. 231, 232, 238
" silos . . . . . ii. 290
" troughs . . . . . i. 151
Condensed milk . . . . . ii. 484
Condensing engines . . . . i. 407, 415
" waste steam . . . . i. 406
Condimental foods . . . . iii. 288
Condiments, use of . . . . iii. 376
Conduits, graded, in drains . . i. 82
" specification for . . . . i. 238
Conical cooler . . . . . ii. 483
" pit for storing potatoes . . ii. 322
Connemara pony . . . . . iii. 46
Constituents of foods . . . . iii. 291
Cooke's one-way plough . . . i. 373
Cooking or steaming food for cattle . iii. 356
Coolers, milk . . . . . ii. 483
Cooley system of raising cream . . ii. 489
Co-operative milk depots . . ii. 485, 522
Coping for dykes . . . . i. 108
" specification for . . . . i. 231
Coprolites . . . . . i. 497
Core-drains . . . . . i. 84
Corn—
Account, statement of . . . i. 253
Basket . . . . . ii. 227
Boxes, specification for . . i. 239
Bunting, the . . . . . ii. 438
Carts . . . . . ii. 190, 191
Chests . . . . . i. 174
Crops . . . . . ii. 89
Crops, conditions in lease . . i. 274
Culture . . . . . ii. 144
Dressing . . . . . ii. 224
Experiments at Woburn . . ii. 48
Fly, the ribbon-footed . . . ii. 450
Forking, in the field . . . ii. 191
Ground-beetle . . . . ii. 455
Growing . . . . . ii. 89
From high manuring . . . ii. 7
Indian, as food for stock . . iii. 272
Measuring, for horses . . . i. 175
Mode of lifting sacks of . . ii. 228
Process of reaping . . . ii. 182
Production in Britain . . . ii. 90
And rice weevil . . . . ii. 455
Sacks . . . . . ii. 229
Sawfly . . . . . ii. 453
Scoop . . . . . ii. 227
Screens . . . . . ii. 225
And seed drill . . . . ii. 124
Shovels . . . . . ii. 227
Stacks . . . . . ii. 189
At the steading . . . . ii. 210

Corn—
Stool for stack . . . ii. 193
Strikes . . . . . ii. 227
Threshing and winnowing . . ii. 222
Thrips . . . . . ii. 456
Tying sacks of . . . . ii. 228
Varieties of . . . . . ii. 91
Corn-band for sheaves . . . . ii. 184
Corn-barn . . . . . i. 180
Corncockle, seed of . . . . ii. 74
Cornish boiler . . . . . i. 408
"Corrimony" fence . . . . i. 115
Corrosion in boilers . . . . i. 410
Corrugated boiler-flue . . . . i. 410
"Cotherstone" cheese . . . ii. 513
Cotswold sheep—
Characteristics . . . . iii. 151
Improvement . . . . iii. 150
Management of . . . . iii. 151
Cottage gardening . . . . ii. 59
Cottages. See Labourers' cottages . i. 206
Cotton-cake . . . . . iii. 276
" caution in using undecorticated iii. 276
" manurial value of . . . iii. 277
" uses of decorticated . . . iii. 277
" value of undecorticated . . iii. 277
County Councils and education . . i. 33
Court. See Cattle-courts . . . i. 161
"Covenanted" rent . . . . i. 269
Cow and horse dung compared . . i. 465
Cow's milk for foals . . . . iii. 327
" for lambs . . . . iii. 378
Cows—
Bulling of . . . . . iii. 333
Carrot-tops as food for . ii. 393, iii. 282
Effects of ventilation and temperature on milk-yield . . . iii. 346
Feeding of . . . . . iii. 344
Feeding dry and breeding . . iii. 346
Food requirements of . . . iii. 303
Malt-combs for . . . . iii. 271
Management of . . . . iii. 330
Milk from different breeds of . ii. 478
Milking of. See "Milking" . iii. 340
Parsnip leaves as food for . . ii. 397
Period of gestation . . iii. 236, 499
Spaying . . . . . iii. 343
Stalls for . . . . . i. 155
Too early bulling unwise . . iii. 333
Cradle-scythe . . . . . ii. 171
Crane-flies . . . . . ii. 449
Cream—
Airing . . . . . ii. 487
Atmospheric influence on . . ii. 490
Cooley system of raising . . ii. 489
Deep-setting of . . . . ii. 489
Devonshire clotted . . . ii. 492
" scalding system . . ii. 490
Effect of food on the churning temperature . . . . . ii. 495
"Gerber" tester . . . . ii. 479
Jar . . . . . ii. 489
Lactocribe for testing . . . ii. 479
Preserving . . . . . ii. 492
Raising . . . . . ii. 486, 491
Ripening . . . . . ii. 404, 493
Scalding . . . . . ii. 490
Selling . . . . . ii. 492
Separated . . . . . ii. 492
Separators, centrifugal . . . ii. 491
Shallow-pan system of raising . ii. 487
Skimmer . . . . . ii. 489
Sleepy . . . . . ii. 499
Straining . . . . . ii. 498
Swartz system of raising . . ii. 489
Cream—
Temperature of, for churning . ii. 494
" of shallow pans . ii. 487
Test-tubes . . . . . ii. 479
Testing percentage of . . . ii. 479
Creameries . . . . . ii. 522
Creamery strainer . . . . ii. 489
Creasoting poles for hops . . . ii. 380
Crested dogstail, seed of . . . ii. 86
Crocks, packing butter into . . ii. 501
Crop pests . . . . . ii. 442
Bean aphis or collier . . . ii. 444
Bean and pea beetles . . . ii. 445
" weevils . . . . ii. 459
Beet carrion beetle . . . . ii. 445
" fly . . . . . ii. 446
Cabbage aphis . . . . ii. 449
" butterflies . . . ii. 446
" flea beetle . . . ii. 448
" moth . . . . ii. 447
" root fly . . . . ii. 447
" " gall-weevil . . ii. 448
Carrot fly . . . . . ii. 445
" wireworms . . . ii. 453
Celery fly . . . . . ii. 449
Click beetles . . . . ii. 454
Cockchafer . . . . . ii. 455
Colorado beetle . . . . ii. 461
Corn ground-beetle . . . ii. 455
" and rice weevil . . ii. 455
" sawfly . . . . . ii. 453
" thrips . . . . . ii. 456
Daddy-long-legs or crane-flies . ii. 449
Death's-head moth . . . ii. 462
Diamond back moth . . . ii. 464
Eelworms . . . . . ii. 470
Flea-beetles . . . . . ii. 463
Flour beetles . . . . . ii. 456
Frit fly . . . . . ii. 451
On fruit . . . . . ii. 467
Garden chafer or bracken clock . ii. 455
Gout-fly or the ribbon-footed corn-fly . . . . . ii. 450
Hessian fly . . . . . ii. 452
Hop aphis . . . . . ii. 456
" fever-fly . . . . ii. 458
" flea or brassy-flea beetle . ii. 458
" frog-fly . . . . . ii. 457
" red-spider . . . . ii. 458
Mangold-leaf maggot . . . ii. 446
Onion-fly . . . . . ii. 459
Paraffin emulsion for . . . ii. 444
Parsnip fly . . . . . ii. 449
Pea beetle . . . . . ii. 445
" midge . . . . . ii. 460
" moth . . . . . ii. 460
" thrips . . . . . ii. 461
" and bean weevils . . . ii. 459
Pigmy mangold beetle . . . ii. 446
Spring-tails . . . . . ii. 466
Surface caterpillars . . . ii. 464
Turnip and cabbage gall-weevil . ii. 463
Turnip-fly or flea-beetle . . ii. 463
" moth . . . . ii. 465
" mud-beetle . . . ii. 462
" sawfly . . . . ii. 466
Wheat bulb-fly . . . . ii. 451
" midge . . . . ii. 452
Wireworms . . . . . ii. 453
Cropping beans . . . . . ii. 152
" conditions of . . . . i. 273
" excise restrictions on . . ii. 403
" legal provisions . . . i. 275
" rank wheat . . . . ii. 129
"Crop sickness" . . . . i. 436

Crops—
Accompanying grass seeds . . ii. 250
Autumn . . . . . ii. 66
Cereal . . . . . ii. 115
Composition of ordinary, per acre i. 326
Conditions favourable to large . ii. 13
Corn . . . . . ii. 89
Different kinds of dung for . . i. 455
Disposal of forage, in summer . ii. 63
Drainage and autumn-sown . . i. 50
Electricity for production of . ii. 404
Elements absorbed by . . . i. 516
Evidence of the, for fertility . i. 450
Exhaustion of soil by removal of . i. 326
Experiments in manuring . . ii. 1
Forage . . . . . ii. 367
Hay . . . . . ii. 251
Insect farm pests. See Crop pests ii. 442
Ingredients removed by . . i. 443, 448
Insuring . . . . . i. 280
For irrigation . . . . . i. 356
Leguminous, and soil nitrogen . i. 435
" enriched with nitrogen i. 324
Lime for . . . . . i. 362
Liquid manure for . . . . i. 482
Making dung or selling . . i. 473
Mangel . . . . . ii. 362
Manures for different . . . . ii. 40
Manures for slow and fast growing i. 517
Potato . . . . . ii. 295
Rainfall and . . . . . i. 264
Rotation of . . . . . i. 433
Saving in, by binder . . . ii. 181
Selling way-going . . . . i. 278
For silage . . . . . ii. 292
Slow manures for slow growing . i. 492
Sowing with spring . . . . ii. 250
Subsidiary farm . . . . . ii. 392
Turnip . . . . . ii. 324
Valuing . . . . . i. 278
Varieties of, in rotation . . i. 440
Way-going . . . . . i. 277
Weeding cereal . . . . . ii. 129
Weight and composition of . . ii. 326
Cross-breeding . . . . . iii. 228
Cross-cultivation for turnips . . ii. 332
Cross-fertilisation of grain . . . ii. 104
Garton's work on . . . . ii. 108
Mr Knight's efforts . . . ii. 105
Organs of fructification . . ii. 105
Percentage of success . . . ii. 108
Period for crossing . . . ii. 107
Mr Raynbird's experiments . . ii. 105
Mr P. Shirreff's experiments . ii. 105
Time of natural fecundation ii. 107
" required to fix type . . ii. 107
Cross-fertilisation of potatoes . . ii. 311
" furrow, depth of . . . ii. 146
" harrowing . . . . . ii. 126
Crosshill's clod-crusher . . . ii. 386
Cross-ploughing . . . . . i. 396
" " land . . . . ii. 144
" " harrowing before ii. 144
Crown-and-furrow ploughing . . i. 395
Crows . . . . . ii. 432
Cruciferous plants, globular-seeded . ii. 73
Cuckoo, the . . . . . ii. 440
Cultivating land for turnips . . ii. 328
Cultivation, antiquity of oat . . ii. 100
Antiquity of wheat . . . ii. 95
Autumn . . . . . ii. 65
Drainage and root . . . i. 50
Of flax . . . . . ii. 384
General principles of corn . . ii. 144
Of hemp . . . . . ii. 402
Cultivation—
Of hops . . . . . ii. 377
Of leeks . . . . . ii. 398
Limits of barley . . . . ii. 97
" rye . . . . . ii. 101
Steam . . . . . i. 421
Cultivators and grubbers . . . ii. 150
" Martin's . . . . . ii. 331
" spring-tined, for flax culture . ii. 386
Culture-starters . . . . . ii. 505
Cultures, soil . . . . . i. 324
Curd-breaker . . . . . ii. 508
" knives . . . . . ii. 508
" mill . . . . . ii. 502
Currants . . . . . ii. 468
Curry-comb, brush, foot-picker, and mane-comb . . . . . iii. 314
Cushat, the, or wood-pigeon . . ii. 434
Cutting and breasting hedges . . i. 95, 96
" hedges . . . . . i. 98
" stage for grain harvest . . ii. 167
Cyanamide calcium . . . . i. 489
Cylindrical milk-coolers . . . ii. 483

Daddy-long-legs or crane-flies . . ii. 449
Dairies, detached . . . . . i. 192
Dairy—
Education in Scotland . . . i. 35
Examinations . . . . i. 36
Farm, steadings for . . . . i. 147
" steadings for suburban . i. 151
" stocking a . . . . i. 5, 288
Farmer, what he should know . i. 5
Schools in England . . . i. 32
Dairy, the . . . . . ii. 475
Butter-making . . . . ii. 493
Cheese-making . . . . ii. 501
Compartments in . . . . ii. 476
Consumption and selling of whole-milk . . . . . ii. 485
Dampness to be avoided . . ii. 476
Destination of the milk . . ii. 484
Factory . . . . . ii. 522
Finishings of the . . . . ii. 476
Herd recorder . . . . . ii. 480
Importance of temperature . ii. 477
Medley in the milk-room . . ii. 476
Milk . . . . . ii. 478
Milk records . . . . . ii. 480
" shelves . . . . . ii. 476
Pasteurisation of milk . . . ii. 481
Power for the . . . . . ii. 477
Purifying and preserving milk . ii. 481
Racks for ripening cheese . . ii. 502
Separate . . . . . ii. 476
Separator . . . . . ii. 491
Shelves for . . . . . ii. 489
Situation of . . . . . ii. 475
Sterilisation of milk . . . ii. 482
Temperature of . . . . . ii. 477
Thermometers . . . . . ii. 477
Utensils . . . . . ii. 477, 486
Verandah . . . . . ii. 476
Dairy cows, beans for . . . . iii. 273
" " feeding of . . . iii. 344
" " grains for . . . iii. 272
" " rations for . . . iii. 344
" " in summer, feeding of . iii. 346
Dairying and market gardening . ii. 397
" in summer . . . . . ii. 63
Dairymaids, duties of . . . . i. 9
Dairy produce, marketing of . . iii. 409
Daisy, seed of ox-eye . . . . ii. 79
Dandelion, seed of . . . . ii. 80
Damp course, specification for . . i. 232

Dari or durra as food for stock . . iii. 273
Dartmoor pony . . . . . iii. 44
" sheep . . . . . iii. 195
Day-book . . . . . i. 247
Dead-hedge . . . . . i. 101
Dead meat, marketing of . . . iii. 407
Deafening, specification for . . i. 242
"Deanston" system of drainage . i. 44
Death's-head moth . . . . . ii. 462
Decorticated cotton-cake, uses of . iii. 277
De Laune's seed mixtures . . . ii. 246
De Laval separator . . . . ii. 483
Deep setting of cream . . . . ii. 489
Deer forest-fly . . . . . iii. 425
" wire fence for . . . . i. 115
Derbyshire cheese . . . . ii. 512
" gritstone sheep . . . iii. 201
Devon cattle . . . . . iii. 101
Early history . . . . iii. 101
Management of herds . . . iii. 104
The milking type . . . . iii. 103
Modern . . . . . iii. 102
Weights . . . . . iii. 103
Devon cattle, South. See "South" . iii. 105
Devon long-wooled sheep—
Characteristics . . . . iii. 152
Early history . . . . iii. 152
Management . . . . iii. 153
Devonshire system of scalding cream . ii. 490
Dew . . . . . i. 26
" beneficial influence of . . . ii. 62
Dexter cattle as beef-producers— . iii. 128
Characteristics . . . . iii. 127
Management . . . . iii. 128
Origin of . . . . . iii. 126
Dexter-Shorthorn, age, weights, and measurements . . . . . iii. 136
Diaphragm churns . . . . . ii. 497
Dibbling . . . . . ii. 159
" machines . . . . . ii. 163
Digestible matter of various foods . iii. 294
Digestion, energy consumed in . . iii. 298
" of food . . . . iii. 292
Digger, potato- . . . . . ii. 317
Diggers and steam-ploughs . . . i. 383
Digging and grubbing . . . . i. 399
" and ploughing . . . . i. 368
" steam . . . . . i. 427
Dipping bath, construction of . . iii. 387
Cost of . . . . . iii. 389
Plans of . . . . . iii. 388
Plunge-bath . . . . . iii. 389
Stone and wood . . . . iii. 389
Tossing sheep into . . . iii. 389
Dipping mixtures . . . . . iii. 389
" composition of dips . . . iii. 389
" carbolic acid and soft-soap . iii. 433
" dressing for scab . . . iii. 390
" lime and sulphur . . . iii. 433
" non-poisonous dips . . . iii. 389
" tobacco and sulphur . . . iii. 433
Dipping sheep . . . . . iii. 387
Bath-steel . . . . . iii. 387
Bathing or "pouring" . . . iii. 387
Former customs . . . . iii. 387
Process of . . . . iii. 387, 388
Swimming-bath . . . . iii. 387
Time of . . . . . iii. 389
Weather for . . . . . iii. 390
Disease, insurance against . . . i. 280
" lime as a preventive of crop . i. 362
Diseases, fungus, of plants . . . ii. 405
" potato . . . . . ii. 296, 316
" of animals . . . . . iii. 436
" of poultry . . . . . iii. 253
Dishley or Leicester sheep . . . iii. 138
Distillery food . . . . . iii. 272
Districts, rainless . . . . . i. 28
Ditcher's shovel . . . . . i. 91
Ditches, scouring . . . . . i. 99
" in pastures . . . . . ii. 284
Divisional fences . . . . . i. 87
Divisions for stall, specification for . i. 235
Dock family, "seeds" of the . . ii. 78
Docking . . . . . iii. 498
" lambs . . . . . iii. 379
Dodder, a parasitic flowering-plant . ii. 423
Dogs, period of gestation . . iii. 236, 499
" rabies . . . . . iii. 493
" sheep . . . . . iii. 264
Donkeys, uses of . . . . . iii. 59
Doors, specification for . . . i. 239, 243
Dorset Down sheep . . . . . iii. 179
Dorset or Somerset horn sheep . . iii. 180
Down or short-wool breeds of sheep . iii. 162
Draff . . . . . iii. 271
Drafting lambs . . . . . iii. 386
Drainage of pastures . . . . . ii. 281
" waters, loss of nitrates in . . ii. 15
" " soil and, at Rothamsted . ii. 3
Draining . . . . . i. 44
Accelerating harvest . . . i. 47
And autumn-sown crops . . . i. 50
And economical manuring . . . i. 51
And irrigation . . . . i. 51, 355
And nitrification . . . . i. 49
And root cultivation . . . i. 50
And soil temperature . . . i. 47, 263
Antiquity of . . . . . i. 44
Best season for . . . . . ii. 66
By contract . . . . . i. 63
Byres and courts . . . . . i. 158
Carbonic acid and oxygen . . . i. 49
Cattle courts . . . . . i. 163
Causes of wetness in land . . . i. 51
Conducive to health . . . . i. 50
Conflicting opinions on . . . i. 45
Cost of, per acre . . . . . i. 70
" of machine- . . . . i. 83
" of mole and pipe . . . i. 78
Customs in executing . . . i. 62
"Deanston" syatem of . . . i. 45
Determining necessity for . . . i. 51
Drained clay-land . . . . i. 50
Efficient, essential to agriculture . i. 44
"Essex" system of . . . . i. 44
Examining soil for . . . . i. 53
Falls in outlets . . . . . i. 53
Fertility from rain-water . . . i. 48
First step in . . . . . i. 51
Grass lands . . . . . i. 84
Hill pasture . . . . . i. 344
Important details . . . . i. 69
Improving pasture . . . . i. 50
Increasing produce . . . . i. 50
Insects attacks less frequent . i. 50
Loans for . . . . . i. 46
Machine . . . . . i. 78
Materials . . . . . i. 57
Men for, work . . . . . i. 63
Mitigating drought . . . . i. 49
Mole . . . . . i. 74
Natural . . . . . i. 51
Need of extended . . . . . i. 84
Nitrogen and sulphuric acid from rain-water . . . . . i. 48
Object of . . . . . i. 46
Outfalls . . . . . i. 52
" from hollows . . . i. 53
" in limestone districts . i. 53

Draining—
Parkes's system of . . . i. 45
Plough . . . . . i. 63
Removing and avoiding boulders . i. 64
Road . . . . . i. 124
Salt from rain-water . . . . i. 48
Skilled labour in . . . . i. 52
Soils retaining water in . . i. 46
Specifications for, contract . . i. 63
Springs. . . . . i. 53
Subterranean outfalls . . . i. 53
Surface. . . . . i. 85
Time for . . . . . i. 52
Varying with soil. . . . . i. 53
Ventilation of the soil in . . i. 49
Waste land . . . . . i. 337
Water-level, lowering . . . i. 49
Water, lime in . . . . . i. 362
Wet and drained clay-land . . i. 50
Drains . . . . . i. 44
Advantages of cylindrical pipe . i. 59
American method of regulating levels i. 67
An established rule as to . . i. 55
Areas of pipes (full-sized) . . i. 81
Causes of obstruction . . . i. 70
Cesspools . . . . . i. 71
Challoner's level for . . . . i. 67
Chart . . . . . i. 70
Clearing choked pipes . . . . i. 71
" rods . . . . . i. 71
Collared pipes . . . . . i. 59
Conditions regulating size of pipes i. 60
Core . . . . . i. 84
Cost of cutting . . . . . i. 68
" of mole and pipe . . . i. 78
" of pipes . . . . . i. 60
Course of main . . . . . i. 55
Deep, and capillary attraction . i. 55
Depth of . . . . . i. 54
Derangement of . . . . . i. 73
Digging-spade . . . . . i. 64
Direction of main. . . . . i. 56
Distance between . . . . . i. 55
Dunghills injurious to . . . . i. 461
Endless-chain system of clearing . i. 72
Fall for main . . . . . i. 55
Filling . . . . . i. 69
Flushing . . . . . i. 71
Gauge . . . . . i. 66
Grating for courts . . . . i. 159
In furrows . . . . . i. 55
Junction of minor and main . i. 56
" pipes . . . . . i. 69
Keeping in order . . . . i. 70
Laying the pipes . . . . i. 68
Levelling-staff for. . . . . i. 67
Liquid manure . . . . . i. 159
Material for . . . . . i. 57
Measures for preventing obstruction i. 71
Number of pipes per acre . . i. 62
Objections to sand . . . . i. 80
Obstruction by iron compounds . i. 70
" of, by roots . . i. 73
Old English . . . . . i. 57
Outfall pipes . . . . . i. 69
Outfalls in main . . . . . i. 55
Peat . . . . . i. 58
Pipe *v.* porous . . . . . i. 80
Pipes, areas of . . . . . i. 81
" for main . . . . . i. 62
" selecting . . . . . i. 59
Placing the dug-out soil . . i. 66
Plug . . . . . i. 57
Porous . . . . . i. 79
Preliminary surveying . . . i. 55

Drains—
Prevention of obstruction by roots i. 73
Quantity of earth removed . . i. 68
Reopening . . . . . i. 71
Root depth . . . . . i. 54
Scoops . . . . . i. 65
Shovel . . . . . i. 66
Specification for . . i. 230, 237, 240, 243
Stone . . . . . i. 58
Strain on pipes . . . . . i. 61
Sub-mains . . . . . i. 55
Symptoms of blocking . . . i. 71
Testing levelness of . . . . i. 66
Tile . . . . . i. 58
Tube, spigot, and faucet . . i. 159
Upright for lower end of . . i. 73
Wedge-and-shoulder . . . . i. 57
Width of . . . . . i. 63
Work, inspecting . . . . . i. 66
Draught of ploughs . . . . . i. 375
Dray's Hussey reaping-machine . . ii. 174
"Dreg" . . . . . iii. 272
Dressing stacks . . . . . ii. 276
" threshing and, machine . . ii. 211
Dried grains as food . . . . iii. 271
Drift soils . . . . . i. 18
Drill cultivator . . . . . ii. 352
" dung-spreader . . . . i. 513
" horse-hoe . . . . . ii. 352
" plough and manure sower . . i. 520
" plough, potato-digging by . . ii. 320
" " Scottish. . . . . ii. 302
" " triple . . . . . ii. 306
" " for turnips . . . ii. 334
" ploughs . . . . . i. 373
" roller . . . . . ii. 307
" sowers . . . . . ii. 124
" " turnip . . . . . ii. 337
" sowing, advantages of . . . ii. 159
" " introduction of . . ii. 334
" width of, for wheat . . . ii. 124
Drilling fallow . . . . . i. 445
Drills, harrowing for beans. . . ii. 152
" sowing manure in . . . . i. 519
Drought, drainage mitigating . . i. 49
Drums, safety-, for threshing-machines ii. 215
Drying, artificial, of grain . . . ii. 202
Dry-stone walls . . . . . i. 105
Ducks . . . . . iii. 240
Dung . . . . . i. 453
A complete manure . . . i. 468, 471
Art of making . . . . . i. 461
Allan's drill, spreader . . . i. 513
Analysis of town stable . . . i. 470
Application of . . . . . i. 511
Carting out . . . . . i. 454, 511
Chaffing litter . . . . . i. 457
Cold weather and loss of nitrogen i. 473
Composition of . . . . . i. 467
Conditions influencing excreta . i. 466
Covered court *v.* open court. . . i. 162
Different kinds of, for crops . i. 455
Dr Anderson on . . . . . i. 469
Economical use of . . . . i. 515
Emptying courts of . . . . i. 457
Extra value of covered-court . i. 463
Farmers now less dependent on . i. 473
Fermentation in . . . . . i. 166
Fertility in a ton of . . . . i. 469
Field-sheds for . . . . . i. 460
Fields to be manured . . . . i. 456
"Fire-fang" in . . . . . i. 465
Fixing ammonia in . . . . i. 468
Flooring of manure-pits . . . i. 463
For bare fallow . . . . . i. 444

Dung—
For grass lands . . . . i. 515
For turnips . . . . . ii. 346
For wheat . . . . . i. 515, ii. 4
Fresh and rotten . . . . i. 468, 470
Heating soil . . . . . i. 471
Horse and cow, compared . . . i. 465
Incorporating the liquid with . i. 481
Injurious to drains . . . i. 461
Injury from "washing" . . i. 464
Intermixing . . . . . i. 512
Is winter carting-out injurious? . i. 460
Lasting influences of . . . i. 471
Light soils . . . . . i. 514
Loss of residual manure . . i. 472
" of time in carting . . . i. 456
Losses from want of care of . i. 453
Making, or selling crops . . i. 473
For mangels . . . . . ii. 465
Manure-court . . . . . i. 460
Manure-pit . . . . . i. 462
Manurial value of straw . . i. 467
Mechanical influence of . . ii. 5
" uses of . . . . i. 471
Methods for preserving nitrogen in i. 459
Mischief from defective water-spouts i. 465
Mixing . . . . . i. 455
Necessity for turning . . . i. 514
Nitrogen in . . . . . ii. 5
" annually lost from . i. 454
No "fire-fang" in open court . i. 167
Oozing of liquid from heaps . i. 463
Pig . . . . . i. 466
Plant-food in . . . . . ii. 4
For potatoes . . . . ii. 297, 299
Practical conclusions . . . i. 473
Preventing fermentation . . i. 459
Process of turning . . . i. 512
Produce of, per head of stock . i. 469
Prof. Wrightson on . . . i. 474
Pumping urine on . . . i. 464
Quantities of, per acre . . i. 515
" " from stock . i. 466
Sheep . . . . . i. 466
Shovel . . . . . i. 512
Soil an unreliable custodian of . i. 472
Southern practice without drills . i. 514
Spade . . . . . i. 460
Spreading . . . . . i. 513
Superiority of, questioned . . i. 472
Supplemented manure . . . i. 514
Symptoms of putrefaction . . i. 513
System of feeding and value of . i. 467
Thermometer . . . . . i. 26
Time of application . . . i. 514
Town stable . . . . . i. 470
Treatment of farmyard . . i. 453
Turning . . . . . i. 458
" and putrefaction . . i. 513
Variety in the quality of . . i. 453
Vegetation and loss of nitrates . i. 473
Well-made . . . . . i. 464
With drills or ridges . . . i. 514
Dunghills—
Position of . . . . . i. 455
Turning . . . . . i. 511
Dunging often and lightly . . . i. 515
" Northern practice of . . i. 515
" and sowing turnips in drills . ii. 336
Durham Cattle, polled . . . iii. 137
Durra or dari as food for stock . iii. 273
Dutch cheeses . . . . . ii. 516
" hoe . . . . . i. 103
Duties of the farmer in summer . ii. 64
Dykes, stone . . . . . i. 105
Ear-marking sheep, system of . . iii. 166
Earnings, weekly, of farm-servants . i. 289
Earth, average composition of its crust i. 306
" or greensward roads . . . i. 125
Eaves, gutter, specification for . . i. 236
Ecology . . . . . i. 14
Economic entomology . . . . i. 15
" wire fencing . . . . i. 121
" zoology . . . . . i. 15
Edam cheese . . . . . ii. 516
Edinburgh University, education at . i. 31
" " first agricultural degree in i. 31
Education. See Agricultural . . i. 30
" scientific, widening . . . i. 11
Educational institutions in Ireland . i. 43
Eelworms . . . . . ii. 470
Egg-ended boiler . . . . . i. 408
Eggs—
Hatching, time of . . . iii. 236
New-laid . . . . . iii. 236
Preserving . . . . . iii. 252
Storing . . . . . iii. 253
Testing . . . . . iii. 250
Winter . . . . . iii. 251
Elder's turnip-cutting cart . . . iii. 395
" sheep fodder-rack . . . iii. 394
Electric driving . . . . . i. 431
Electrical engineering . . . . i. 22
Electricity . . . . . i. 21, 24
" in agriculture . . . . ii. 404
Elements, chemical, important to farmers i. 12
Elevating apparatus for hoisting hay . ii. 274
Elevation and local climate . . . i. 263
" and temperature . . . i. 263
" of ploughs . . . . . i. 369
Elevator, hay . . . . . ii. 275
" of reaper-binder . . ii. 178
" straw and hay . . . . ii. 215
Embryo in seed germination . . ii. 156
Employment, piece work, of servants . i. 294
Enclosure and shelter . . . . i. 86
End-over-end churns . . . . ii. 496
Enemas . . . . . iii. 497
Enemies of live stock, insect . . iii. 417
Energy value of foods . . iii. 297
Engineering—
Electrical . . . . . i. 22
Sanitary . . . . . i. 22
Engines—
Condensing . . . . . i. 407
Gas and oil . . . . . i. 428
Internal combustion . . . i. 21
Steam . . . . . i. 404
Wind . . . . . i. 432
England, cattle-feeding in . . . iii. 368
English barns . . . . . i. 178
" custom of entering a farm . . i. 277
" " of offering for farms . i. 271
" farms, stocking of . . . i. 286
" steading, modern . . . i. 139
" wheel-plough . . . . i. 371
English and Irish ponies . . . iii. 41
Enoch's refrigerator . . . . ii. 484
Ensilage . . . . . ii. 289
Crops for . . . . . ii. 272
Experiments . . . . . ii. 50
Entering and renting farms . . . i. 261
Entomology, economic . . . . i. 15
" literature of . . . ii. 471
Entrance-gates . . . . . i. 120
" specification for . . . i. 234
Epizootic abortion . . . . iii. 334
Equipment of a farm . . . . i. 22
" " with buildings . i. 126
" of houses for cattle . . . i. 151

Equipment, stable . . . . i. 167
Ergot . . . . . ii. 89, 414
" causing abortion . . . . iii. 334
Estate and farm roads. See Roads . i. 122
Evaporation . . . . . i. 263
And loss of heat in drainage . i. 46
From soils . . . . . i. 309
In spring . . . . . ii. 59
Ewart, Prof. Cossar, Pony trials . iii. 54
Ewes, abortion among . . . iii. 381
" ailments among . . . iii. 381
" attention to, in winter . . ii. 67
" flushing . . . . . iii. 390
" period of gestation . . . iii. 236
" treatment of, and lambs . . iii. 386
Exoise restrictions on cropping . . ii. 403
Excavations, specification for . i. 230, 241
Excreta, conditions influencing . i. 466
Exmoor pony . . . . . iii. 44
Exmoor sheep—
Characteristics . . . . iii. 194
Management . . . . iii. 195
Experiments in Aberdeenshire . . ii. 51
" with cows as to milk yield . iii. 346
" on feeding cattle (1832-1909) . iii. 371
" with foods for sheep on roots . iii. 397
" on cross-fertilisation of grain . ii. 105
" Rothamsted barley . . . ii. 133
" with Highland ponies . . . iii. 54
" limited guidance of manuring . i. 517
" with manure at Rothamsted . ii. 1
" in manuring hops . . . ii. 380
" in manuring turnips . . . ii. 350
" in manuring turnips at Carbeth . ii. 342
" with manures by H. & A. S. . ii. 33
" with manures, &c., by R. A. S. E. ii. 42
" in manuring, method of test . i. 451
" on improving hill pasture . . i. 344
" by agricultural colleges, &c. . ii. 56
" with potatoes . . . . ii. 298, 299
" in tedding . . . . . ii. 260

Factory churns . . . . . ii. 497
" dairy . . . . . ii. 522
Fahrenheit scale . . . . . i. 25
" thermometer . . . i. 26
Fairs, modern . . . . . iii. 408
"Fairy rings" in pastures . . . ii. 287
Fallow and loss of nitrates . . . i. 441
Bare . . . . . i. 441
"Bastard" . . . . . i. 445
Wheat . . . . . ii. 117
Family cottages. See Farm cottages . i. 206
Fanners . . . . . ii. 222
Farm, birds in relation to the . . ii. 431
" cart, Jack's . . . . ii. 318
" crops, insect pests . . . . ii. 442
" crops, subsidiary . . . . ii. 392
" field operations on the . . ii. 57
" mammals in relation to the . ii. 424
" plants, new varieties of . ii. 116
" the seasons, weather and work . ii. 57
" seeds. See Seeds . . . ii. 70
" tip-cart . . . . . ii. 349
" waggon . . . . . ii. 191
" work, subdivision of . . . ii. 60
" " summary of summer . ii. 62
Farms—
Access to water in enclosing . i. 89
Adapting conditions to different . i. 273
Adjusting labour . . . . i. 280
And estate roads. See Roads . i. 122
Capital for suburban . . . i. 5
Conditions of lease . . . . i. 271
" regulating rent . i. 261
Farms—
Considering offers for . . . i. 271
Desirable . . . . . i. 266
Diversity of . . . . . i. 261
Division of fields in . . . i. 88
English custom in offering for . i. 271
Entering . . . . . i. 277
Estimating rent . . . . . i. 267
Extent of carse . . . . . i. 5
" of mixed . . . . . i. 6
Fencing pastoral . . . . . i. 89
Grass paddocks on . . . . i. 89
Ill-appointed . . . . . i. 270
Insurance of stock on . . . . i. 280
Landowners "asking" rent for . i. 271
Laying out and equipping . . i. 22
Offering for . . . . . i. 270
Persons who conduct the labour of . . . . . i. 6
Physical geography of . . . i. 261
Produce-rent of . . . . . i. 268
Renting and entering . . . i. 261
Shelter on upland . . . . i. 90
Situations of. . . . . i. 264
Stocking . . . . . i. 281
" carse-land . . . . i. 5
" dairy . . . . . i. 5
" pastoral . . . . . i. 4
Term of tenancy . . . . . i. 267
Terms of entry . . . . . i. 277
Valuing sheep stocks on . . i. 279
Farm book-keeping . . . . . i. 244
Farm buildings. See also Steadings . i. 126
Barns and granaries . . . i. 175
Bothies . . . . . i. 226
Cottages . . . . . i. 206
Different classes of . . . . i. 127
Drains of . . . . . i. 158
Equipment of houses for cattle . i. 151
Evils of "led farms" . . . i. 126
General principles of . . . i. 126
Grouping . . . . . i. 129
Live stock in . . . . . i. 129
Principles of arrangement . . i. 129
Roads . . . . . i. 128
Shelter . . . . . i. 128
Sites on sloping farms . . . i. 128
Situation of the steading . . i. 127
Specification for . . . . . i. 229
Stable equipment . . . . i. 167
Straw in . . . . . i. 129
Value of good . . . . . i. 126
Ventilation . . . . . i. 157
Water-supply of . . . . i. 128
Farm cottages . . . . . i. 206
Accommodation of . . . i. 207, 223
Alternative plans . . . . i. 212, 213
Box-beds . . . . . i. 208
Cheap brick and wood . . . i. 223
Composite . . . . . i. 223
Conditions of Board of Agriculture . . . . . i. 207
Cost of . . . . . i. 223
Erected at Raith, plan of . . i. 224
Specification of, erected at Raith . i. 224
Various designs . . . . i. 206-224
Farm dwelling houses . . . . i. 189
Cellar plan . . . . . i. 192
Chamber plan . . . . . i. 193
Cheese-room of . . . . i. 191
Detached dairies . . . . i. 192
Elevations and section of . i. 193
First design of first-class . i. 192
General principles for . . i. 201
Ground-plan of . . . . i. 192

Farm dwelling-houses—
House and farm to correspond . i. 205
Milk-house . . . . . i. 190
Outline and ornamentation . . i. 197
Plan of kitchen, &c. . . . i. 189
Plans of . . . . . i. 192
Position of, and steading . . i. 189
Second-class . . . . . i. 201
Second design of first-class . . i. 192
Third-class . . . . . i. 201
Upper storey of . . . . . i. 190
Working part of . . . . . i. 189
Farm fences. See Fences . . . i. 86
Farm-labour, distribution of . . i. 2
Farm live stock . . . . . iii. 1
Ailments of . . . . . iii. 435
Names suitable for . . . . iii. 330
Nomenclature of . . iii. 224, 330, 403
Periods of gestation . . . iii. 236
Principles of breeding . . . iii. 224
Treatment of . . . . . iii. 313
Farm-pupils . . . . . i. 1, 2, 3
Farm servants . . . . . i. 289
Average earnings per week . i. 290
Bothies for . . . . . i. 226
Care of farm horses . . . i. 293
Cottages for . . . . . i. 206
Farm managers . . . . . i. 293
Methods of hiring . . . . i. 289
Piece-work employment . . i. 294
Wages of . . . . . i. 289
Farm service—
"Arles" . . . . . i. 294
Board and lodging . . . . i. 294
Character . . . . . i. 295
Death or bankruptcy of employer i. 295
Dismissal . . . . . i. 295
Duties of servants . . . . i. 294
Enlistment of servant . . . i. 295
Law of . . . . . i. 294
Marriage of servant . . . i. 295
Notice of leaving . . . . i. 295
Payment of wages, &c. . . . i. 294
Period of engagement . . . i. 294
Sickness or accident . . . i. 295
Travelling expenses . . . . i. 294
Workmen's Compensation Act, 1906 i. 296
Farm steward, duties of . . . i. 6
Farm students . . . . . i. 1
Farmers—
Advantage of a training to . . i. 3
As retailers . . . . . iii. 416
Duties of . . . . . i. 6
Duties in summer . . . . ii. 64
Garden . . . . . ii. 59
Holiday . . . . . ii. 64
Pastoral . . . . . i. 5
Sciences to be studied by . . i. 11
Succeeding good and bad . . i. 266
Tutor . . . . . i. 1, 2
Farming—
Acquiring a knowledge of . . i. 1
Barns for sheep and arable . . i. 134
Carse-land . . . . . i. 5
"Common" . . . . . i. 5
Dairy . . . . . i. 5
Different systems of . . . i. 4
Difficulties in learning . . . i. 2
Foresight essential in . . . i. 2
Mixed . . . . . i. 6
Pastoral, the simplest system . i. 4
Selecting a system of . . . i. 6
Steading for arable . . . i. 135
" dairy . . . . i. 147
" pastoral . . . . i. 130
Farming—
Steading, suburban . . . i. 148
Suburban . . . . . i. 5
Woad . . . . . ii. 403
Farmyard, gate for . . . . i. 120
Farmyard manure. See Dung . . i. 453
Farrowing of sows . . . . iii. 217
Fat cattle, carcase weight of . iii. 410
" selling, in spring . . ii. 59
" " in summer . . ii. 63
Fat-globules in milk . . . . ii. 479
Fat sheep, selling, in summer . ii. 63
Fattening cattle, management of store iii. 355
" " in winter . . . iii. 363
Feeding—
Cakes, adulteration of . . . iii. 276
Calves . . . . . iii. 351
Cattle, byres for . . . . i. 158
" stalls for . . . . i. 155
Of cows . . . . . iii. 344
Dairy herds . . . . . iii. 344
Experiments . . . . . ii. 50
" review of (1832-1909) iii. 371
Hay for . . . . . ii. 254
Horses . . . . . iii. 316
" revolution in system of . i. 172
Poultry . . . . . iii. 247
Of stors cattle in winter . . iii. 358
System of, and value of dung . i. 467
Typical rations . . . . iii. 344
Value of clovers . . . . iii. 284
" hay . . . . iii. 286
" silage . . . . ii. 293
" straw . . . . iii. 287
" wheat . . . . iii. 269
Feeding-box for sheep . . . iii. 169
Feering . . . . . i. 392
Feerings, ploughing ridges and . ii. 146
Fell pony, the . . . . . iii. 45
" and Arab ponies . . . iii. 52
Felt on roofs, specification for . i. 235
Fences . . . . . i. 86
Anomalies in ploughing near . i. 87
Boundary . . . . . i. 86
Divisional . . . . . i. 87
Dykes as . . . . . i. 109
Economical . . . . . i. 89
Farm . . . . . i. 86
General considerations . . i. 86
Hawthorn . . . . . i. 103
In upland districts . . . i. 90
Maintenance and repair of . i. 86
Pastoral farms . . . . i. 89
"Peignon" . . . . . i. 121
Permanent . . . . . i. 91
Repairing, in summer . . ii. 63
Ring- . . . . . i. 86
Sheet-iron . . . . . i. 115
Shelter from . . . . . i. 87
" overdone . . . . i. 89
Stake-and-rice . . . . i. 101
Steps for . . . . . i. 120
Straightening fields for . . i. 87
Sunk . . . . . i. 110
Turf . . . . . i. 103
Waste of ground by . . . i. 89
Wayfares and . . . . i. 88
Wire . . . . . i. 103
" field. See Wire fences . i. 110
Fermentation in dung in cattle-courts i. 166
" preventing, in dung . . i. 459
Fertilisation, cross-, of grain . ii. 104
" of potatoes . . . . ii. 311
Fertilisers . . . . . i. 515
" and Feeding Stuffs Act . i. 506

Fertility in sheep . . . . . iii. 390
Fertility of soil . . . . . i. 317
Accumulation of . . . . . i. 322
Exhaustion and restoration of . i. 447
From rain-water . . . . . i. 48
In a ton of dung . . . . . i. 469
Restoring . . . . . i. 448
Sources of, in soil. . . . . i. 319
Feacue grass, seeds of . . . . . ii. 85, 86
Feudal customs . . . . . i. 276
Field-bean . . . . . ii. 146
" madder, seed of . . . . . ii. 81
" -mouse . . . . . ii. 427
" operations, autumn weather and ii. 65
" " and spring weather . ii. 57
" peas . . . . . ii. 147
" pits for potatoes . . . . . ii. 321
" slug . . . . . ii. 473
" sports in autumn . . . . ii. 65
" stacks . . . . . ii. 202
" -vole . . . . . ii. 428
" work in winter . . . . . ii. 66
Field-fences . . . . . i. 86
Field-gates . . . . . i. 117
Angle-iron . . . . . i. 119
Construction of . . . . . i. 118
Deficiency of common . . . . i. 119
Entrance gates . . . . . i. 120
" " specifications for . i. 234
Fastening . . . . . i. 121
Fence steps . . . . . i. 120
Gate for farmyard . . . . . i. 120
Hanging . . . . . i. 120
Iron . . . . . i. 119
Painting . . . . . i. 121
Posts for . . . . . i. 121
Preserving gate-posts . . . . i. 121
Wickets . . . . . i. 120
Wire . . . . . i. 121
Wooden . . . . . i. 119
Wrought-iron, specification for . i. 235
Field-workers, duties of . . . . i. 9
Fields—
Convenient . . . . . i. 88
Division of, on a large farm . . i. 88
Large . . . . . i. 88
Shape of, in fencing . . . . i. 87
Shelter overdone in enclosing . i. 89
Size of . . . . . i. 88
Small . . . . . i. 88
Straightening, in fencing . . i. 87
Filter, milk . . . . . ii. 488
Finches, the . . . . . ii. 438
Finger-and-toe . . . . . ii. 417
" experiments with, in turnips . ii. 49, 54
Fire, insurance against . . . . i. 280
Fire-clay mangers . . . . . i. 173
Fire-extinguishers . . . . . i. 280
"Fire-fang" in manure . . . . i. 465
" " preventing . i. 166
Fire-grate, proportions of the . . i. 409
Fish guano . . . . . i. 487
" products as animal food . . iii. 290
Fishery Div. of Board of Agriculture . i. 40
Flail for threshing rye-grass . . ii. 278
Flat milk cooler . . . . . ii. 483
Flauchter-spade . . . . . i. 350
Flax . . . . . ii. 384
Bolls containing seed . . . . ii. 389
Clod-crushers . . . . . ii. 385
Culture . . . . . ii. 384
Dodder . . . . . ii. 423
Drying . . . . . ii. 390
Grass seeds with . . . . . ii. 387
Growing for fibre and seed . . iii. 275
Flax—
Manuring . . . . . ii. 387
Method of pulling . . . . ii. 388
Norwegian harrow . . . . ii. 386
Outlet for straw . . . . . ii. 391
Pulling, steeping, and drying . ii. 388
Rippling . . . . . ii. 388
Rotation for . . . . . ii. 385
Scutching . . . . . ii. 390
Seed . . . . . ii. 387-391
Soil for . . . . . ii. 385
Sowing . . . . . ii. 387
Spring-tined cultivator . . . ii. 386
Tillage for . . . . . ii. 385
Weeding . . . . . ii. 388
Yield of . . . . . ii. 390
Fleas, pulicidæ or . . . . . iii. 425
Fleeces of wool . . . . . iii. 404
Flemish scythe . . . . . ii. 170
Flesh-flies . . . . . iii. 424
Flies injuries to live stock . . . iii. 418
" useful . . . . . ii. 469
Flock management . . . . . iii. 376
Flooring of hyres . . . . . i. 156
" specification for . . . i. 239, 242
Floors—
Of stables . . . . . i. 169
Specification for concrete . . i. 232
" for gravel . i. 231
" for loft . . . i. 234
Flour beetles . . . . . ii. 456
" rye- . . . . . ii. 102
" wheat for . . . . . ii. 93
Flowering season for wheat . . ii. 130
Flowers, farm culture of . . . ii. 401
Flue, corrugated boiler . . . i. 410
Flues for stacking hay . . . ii. 271
Flushing drains . . . . . i. 71
" ewes . . . . . iii. 390
Flying-stock on a "common" farm . i. 6
" on a pastoral farm . . . i. 4
Fly-catcher, the spotted . . ii. 437
Foaling—
Abortion in mares . . . . iii. 324
After foaling . . . . . iii. 326
Assistance in . . . . . iii. 325
Box . . . . . i. 174
Care of brood mares . . . iii. 325
Cleansing . . . . . iii. 326
Difficult . . . . . iii. 326
Insurance against risks . . iii. 324
Mare's udder . . . . . iii. 326
Reviving an exhausted mare . iii. 326
Support to mare's belly . . iii. 326
Symptoms of . . . . . iii. 325
Troublesome mares . . . iii. 327
Working nurse-mares . . . iii. 328
Foals—
Attention to . . . . . iii. 326
Attention to mare . . . iii. 329
Bean-milk for . . . . iii. 327
Beginning to suck . . . iii. 327
Cow's milk for . . . . iii. 327
Feeding at weaning time . . iii. 329
Health of . . . . . iii. 328
Housing mares and . . . iii. 328
Linseed, &c., for . . . iii. 328
Nursing motherless . . . iii. 327
Rearing . . . . . iii. 327
Reviving weak . . . . iii. 326
Weaning . . . . . iii. 328
Fodder-racks for sheep . . . iii. 394
" for store cattle . . . . iii. 361
Foggage for grazing . . . . ii. 284
Fomentations . . . . . iii. 497

Food—
Albuminoid ratios . . iii. 299
Composition of . . . iii. 290
Condimental . . . . iii. 288
Constituents of . . . iii. 291
Digestible matter of various . . iii. 294
Digestion of . . . . . iii. 292
Economy of, in cattle-courts . i. 162
Energy value of . . . . iii. 297
Experiments with cattle, sheep, and goats . . . . iii. 294
Functions of . . . . iii. 291
Manurial constituents of 1000 lb of ordinary . . . . i. 329
Manurial residue of . . . i. 329
Manurial value of . . . iii. 303
Oats as, for stock . . . . ii. 100
Requirements of animals . . iii. 301
Supply . . . . . i. 440
And temperature for churning . ii. 495
Varieties of, for stock . . iii. 269
"Foot-pound" and horse-power . i. 405
Foot-rot and abortion . . . iii. 381
" dressing for . . . iii. 170
Forage crops . . . . . ii. 367
" " crimson clover as . . ii. 375
" " disposal of . . . ii. 63
" " importance of . . ii. 368
" " maize as . . . . iii. 288
" " prickly comfrey as . . iii. 289
" " sorghum as . . . iii. 289
" " vetches as . . . iii. 288
Force required for a ton weight on roads i. 123
Forecasts, weather . . . . i. 20
Foreign breeds of cattle . . . iii. 137
" " horses . . . iii. 61
" " sheep . . . iii. 205
" cheeses suitable for Britain . ii. 515
Forest-fly . . . . . iii. 424
" Pony, New . . . . iii. 44
Foretelling weather . . . . i. 30
Forfarshire steading . . . . i. 141
Forget-me-not, seed of . . . ii. 82
Forker, second . . . . . ii. 194
Forking corn in the field . . . ii. 191
" hay by hand in stack-building . ii. 271
Forks, harvest . . . . . ii. 191
Formation of soils . . . . i. 18
Foundations, specification for . i. 231, 237, 241
Fowls. See Poultry . . . . iii. 236
Fox, the . . . . . ii. 424
Frames for farm cart . . . . ii. 190
Fresh butter . . . . . ii. 501
Frey Bentos guano . . . . i. 487
Friction of the earth in ploughing . i. 374
Frit-fly . . . . . ii. 451
Frost, influence of . . . . ii. 68
" injuring clover seeds . . ii. 250
" throwing out plants . . . ii. 68, 118
Fructification, organs of . . . ii. 105
Fruit, bush . . . . . ii. 400
Fruit-trees, winter washing of . ii. 457
Fruits . . . . . ii. 77
" insect pests injurious to . ii. 467
" multiple . . . . . ii. 82
Fuel, amount of, per horse-power . i. 405
" value of different kinds of . i. 405
Functions of food . . . . iii. 291
Fungoid attacks on hops . . . ii. 381
Fungus diseases of plants . . . ii. 405
Furrow, water- . . . . . ii. 137
Furze, gorse or whin . . . . ii. 376
" as winter food . . . . iii. 283
" for horses . . . . . iii. 319
"Fylde" cheese . . . . ii. 513

Gad-flies . . . . . iii. 418
"Gaiting" . . . . . ii. 187
"Gaitine," carting . . . . ii. 192
Galloway cattle—
Blue-greys . . . . . iii. 75
Characteristics of . . . . iii. 74
Early history . . . . iii. 71
Herd-Books . . . . . iii. 73
Improvement of the breed . . iii. 72
Management of . . . . iii. 76
Points of the breed . . . iii. 76
Weights . . . . . iii. 74
Galloway horses . . . . . ii. 18
" ponies . . . . . iii. 48
" tubes . . . . . i. 408
Game restrictions in lease . . . i. 272
" wire field-fences for . . . i. 116
Game-birds . . . . . ii. 441
Game-proof fence . . . . . i. 110
Garden, the farmer's . . . . ii. 59
" slug . . . . . ii. 473
" snail . . . . . ii. 472
Gardening, cottage . . . . ii. 59
" market . . . . . ii. 397
Gardner's turnip-cutter . . . iii. 395
Garget among ewes . . . . iii. 381
Garton's work as hybridisers . . ii. 108
Gas- and oil-engines . . . . i. 428
Gas-engine, working of . . . i. 428
Gas-lime . . . . . i. 366, 505
Gas-producing plant, suction . . i. 430
Gate-piers, specification for caps to . i. 231
Gates. See Field-gates . . . i. 117
Gauge—
Drain . . . . . i. 66
For road-metal . . . . i. 124
Position of the rain- . . . i. 27
Sheaf- . . . . . ii. 170
Gauging snowfalls . . . . i. 28
Gawe or water-rune . . . . i. 400
Geese . . . . . iii. 245
General chemistry . . . . i. 13
Generating electric power . . i. 431
Generators, tubular steam . . i. 409
Geography, physical, of farms . . i. 261
Geological survey . . . . i. 19
Geology . . . . . i. 18
Geranium, seed of Dove's-foot and cut ii. 75
"Gerber" tester . . . . . ii. 479
Germination of barley and the weather ii. 132
Germination of seeds . . . . ii. 154
Advantages of drill sowing . . ii. 159
Air and germination . . . ii. 155
Changes incidental to . . . ii. 156
Composition of seeds . . . ii. 156
Conditions essential for . . ii. 155
Deep and shallow sowing . . ii. 164
Destruction of seed . . . ii. 166
Dibbling . . . . . ii. 159
Dibbling-machines . . . . ii. 163
Different methods of sowing and . ii. 157
Disadvantages of broadcast sowing ii. 157
The embryo . . . . . ii. 156
Importance of economising seed . ii. 161
Methods of sowing compared . ii. 162
Moisture and . . . . . ii. 155
Multiple stems or "tillering" . ii. 157
Produce from methods of sowing . ii. 161
Quantity of seed per acre . . ii. 161
Seed dissected . . . . . ii. 157
Thick and thin sowing . . . ii. 161
Tillering . . . . . ii. 161, 165
Transplanting . . . . . ii. 166
Waste of seed . . . . . ii. 159
The young plant . . . . ii. 156

Gestation, periods of . . iii. 236, 331, 499
Giblet-checks, specification for . . i. 238
Gilbert, Sir Henry, on dung for potatoes ii. 300
Gilbert's, Lawes and, manurial tables iii. 304
Glacial-drift . . . . . i. 18
Glazing, specification for . . . i. 236, 243
Gloucester cheese . . . . ii. 513
Goats . . . . . iii. 8, 206
Feeding experiments with . . iii. 294
Management of . . . . iii. 208
As milkers . . . . . iii. 206
Period of gestation . . . iii. 236
Selection of . . . . . iii. 208
Varieties of . . . . . iii. 207
Goldfinch, the . . . . . ii. 439
Gooseberries . . . . . ii. 400
Aphides . . . . . ii. 468
Magpie moth . . . . . ii. 468
Mildew . . . . . ii. 412
Sawfly . . . . . ii. 468
Gorgonzola cheese . . . . ii. 518
Gorse . . . . . ii. 376
" (whins or furze) as winter food . iii. 283
Gouda cheese . . . . . ii. 517
Gout-fly, or the ribbon-footed corn-fly ii. 450
Government grants for education . i. 39
" " to agricultural colleges i. 33
Gradients in farm roads . . . i. 123
Grading in stock-breeding . . . iii. 228
Grain—
Artificial drying of . . . ii. 202
Bagging . . . . . ii. 228
Bruised, as food . . . . iii. 357
Crop values . . . . . ii. 90
Cross-fertilisation of . . . ii. 104
Degeneracy of . . . . . ii. 104
Garton's work as hybridisers . ii. 108
Imperial bushel measure for . ii. 227
Marketing, in winter . . . ii. 67
Mendel's laws and improvement of ii. 110
Threshing in winter . . . ii. 67
Grain-drying racks . . . ii. 202, 208
" shed . . . . . ii. 207
Grain harvest . . . . . ii. 167
Artificial drying . . . . ii. 202
Bands and binding . . . . ii. 184
Beginning of . . . . . ii. 167
Cost of cutting with binder . . ii. 181
Cutting barley . . . . ii. 168
" thatch . . . . ii. 200
Degrees of ripeness . . . ii. 169
Grain-drying racks . . ii. 202, 208
" shed . . . ii. 207
Judging ripeness . . . . ii. 168
Labour . . . . . ii. 169
Loss by too early cutting . . ii. 167
Manual and self-delivery machines ii. 176
Process of reaping . . . ii. 182
" of stacking . . . ii. 189
" of thatching . . . ii. 195
Raking . . . . . ii. 185
Reaping appliances . . . ii. 169
" barley . . . . ii. 187
" oats . . . . ii. 182
" wheat . . . . ii. 188
Richmond grain-drying rack . ii. 202
Ripening process . . . . ii. 168
" in the sheaf . . . ii. 167
Self-binder. See Binder . . ii. 177
Shedding or "shaking" . . . ii. 168
Size of sheaves . . . . ii. 185
Stack-heating . . . . ii. 200
" ventilators . . . . ii. 201
Stacking cereals . . . . ii. 189
Stooking or shocking . . . ii. 185
Grain-rent . . . . . i. 268
Graip . . . . . i. 513
" potato- . . . . . ii. 315
Grana or Parmesan cheese . . . ii. 517
Granaries. See Barns . . . i. 175
" preserving wheat in . . . ii. 94
Grants for education and research . i. 39
Grass—
And rotation . . . . . i. 437
And soil nitrogen . . . . i. 434
Lands, drainage of . . . i. 84
" dung for . . . . i. 515
" effects of lime on . . i. 362
Paddocks . . . . . i. 89
Grasses and clovers. See also Clover. ii. 230
Analyses of . . . . . iii. 286
Clifton Park system of growing . ii. 287
Composition of . . . . iii. 284
Cutting early and late . . . ii. 255
For different soils . . . ii. 245
Early grazing from permanent . ii. 287
As food . . . . . iii. 284
Hay crop from permanent . . ii. 287
" experiments. See Rothamsted ii. 23
Ill-suited mixtures . . . ii. 255
Injury to young . . . . ii. 192
Mildew of . . . . . ii. 412
Parks, letting in spring . . ii. 59
For permanent pastures . ii. 245, 285
Seeds, depth for . . . . ii. 247
" identification of . . . ii. 82
" with flax . . . . ii. 387
" rolling for . . . . ii. 249
" for rotation . . . ii. 244
" sowing . . . . ii. 247
" " with another crop . ii. 286
" " without another crop ii. 286
Varieties of . . . . . ii. 230
Varieties of, sown . . . ii. 244
Crested dogstail . . . ii. 233
Evergreen meadow-grass . ii. 240
Fine-leaved sheep's fescue . ii. 236
Fiorin or creeping bent . . ii. 231
Floating sweet grass . . ii. 237
Hard fescue . . . . ii. 236
Italian rye-graes . . . ii. 238
Meadow fescue . . . ii. 85, 234
" foxtail . . . ii. 83, 231
Perennial rye-grass . . ii. 237
Red fescue . . . . ii. 236
Rough cocksfoot . . . ii. 233
Rough-stalked meadow-grass ii. 240
Smooth-stalked meadow-grass ii. 239
Sweet-scented vernal . . ii. 231
Tall fescue . . . . ii. 235
Tall oat-grass . . . ii. 84, 233
Timothy or meadow catstail . ii. 239
Various-leaved fescue . . ii. 235
Water meadow-grass . . ii. 241
Yellow oat-grass . . . ii. 232
Wheat after . . . . ii. 119, 127
Grates, specification for air- . . i. 232
Grating, drain, for courts . . . i. 159
Gravel floors, specification for . . i. 231
Gravelly soils . . . . . i. 299
Gravity, specific, of soils, minerals, &c. i. 24
Grazing, early, from permanent grass . ii. 287
Great Britain, rainfall in . . . i. 29
Green-bottle fly . . . . . iii. 423
Green-manuring . . . . . i. 445
" " experiments at Woburn ii. 47
Greenfinch, the . . . . . ii. 439
Green-fly . . . . . ii. 457
Greens, &c., culture of . . . ii. 398
Greensward roads . . . . i. 125

Greenwich mean temperature . . i. 26
Grooming cattle for shows . . . iii. 376
"Grooving" in boilers . . . i. 411
Growth, average composition of grasses and clovers at different stages of . iii. 285
Grubbers . . . . . ii. 330
" and cultivators . . . . ii. 150
Grubbing, advantages of . . . ii. 117
" and digging . . . . i. 399
" for turnips . . . . . ii. 330-332
" for wheat . . . . . ii. 117
Gruyère cheese . . . . . ii. 516
Guano. See Manures, varieties of . i. 486
Guernsey cattle—
Characteristics . . . . iii. 133
Herd-Book . . . . . iii. 134
Management of . . . . iii. 134
Milking properties . . . iii. 133
Points of the breed . . . iii. 133
Gullies, specification for . . . i. 230
Gulls . . . . . ii. 441
Gypsum . . . . . i. 504

Hackney and harness ponies . . iii. 42
Hackney horse . . . . . iii. 37
Characteristics . . . . iii. 39
Alterations in form . . . iii. 40
Historical . . . . . iii. 38
Management of . . . . iii. 40
Practice of breeding . . . iii. 38
Soundness—veterinary examination iii. 40
Hsiks, specification for . . . i. 239
Haims . . . . . i. 379
Hainault scythe . . . . . ii. 170
Hair-grass, seeds of . . . . ii. 88, 89
Half-bred sheep—
Characteristics . . . . iii. 160
Distribution of . . . . iii. 159
Early lambs from . . . iii. 159
Founding of the breed . . . iii. 158
Management of . . . . iii. 161
Sale centres . . . . . iii. 160
Two classes of . . . . iii. 159
Half-ploughing . . . . . ii. 332
Hall's manurial tables . . . iii. 311
" refrigerating machine . . ii. 484
Hammels . . . . . i. 154
Hammer nut-key . . . . . i. 390
Hampshire Down sheep—
Characteristics . . . . iii. 170
Breeding from lambs . . . iii. 171
Description . . . . . iii. 172
Management . . . . . iii. 172
Shepherd's competitions . . iii. 172
Hand-hoeing beans . . . . ii. 152
Hand-hoes . . . . . ii. 353
" -pick . . . . . i. 91
" threshing-machine . . . ii. 216
Hares and rabbits . . . . ii. 429
Harness for plough . . . . i. 379
" pegs . . . . . i. 173
" room . . . . . i. 173
Harness ponies, Hackney and . . iii. 42
Harrison M'Gregor's self-delivery reaper ii. 176
" " mower . . ii. 257
Harrowing—
For barley . . . . . ii. 132
Before cross-ploughing . . ii. 144
Cross- . . . . . ii. 126
Drills for beans . . . . ii. 152
Efficient . . . . . ii. 126
Oats . . . . . ii. 136, 137
Potatoes . . . . . ii. 320, 321
Process of . . . . . ii. 125
Turnip land . . . . . ii. 330
Harrowing—
Wheat . . . . . ii. 118
After wheat . . . . . ii. 125
The wheat-braird . . . . ii. 250
Harrows—
Carriage for . . . . ii. 249
Chain . . . . . ii. 249
Grass-seed . . . . . ii. 248
Iron . . . . . ii. 125
Norwegian, for flax culture . ii. 386
Working wide . . . . ii. 249
Harvest. See also Grain harvest . ii. 167
Cart . . . . . ii. 190
Forks . . . . . ii. 191
Mouse . . . . . ii. 428
Weather and . . . . ii. .65
Work, magnitude of . . . ii. 65
Harvester. See Binder . . . ii. 177
" the stripper- . . . . ii. 182
Harvesting beans, peas, and tares . ii. 208
" flax . . . . . ii. 388, 389
" grain . . . . . ii. 167
" hops . . . . . ii. 381
" by motor . . . . . ii. 182
Hatching, time of . . . . iii. 236
Haulm or bean- and pea-straw . . ii. 148
Hawk, sparrow- . . . . . ii. 431
Hawthorn hedge . . . . . i. 92, 103
Hay—
Aftermath . . . . ii. 253, 254
American, collector . . . ii. 267
Barns . . . . . i. 177; ii. 270
Best stage for cutting . . ii. 254, 255, 263
Bosses or flues . . . . ii. 271
Building field-stacks . . . ii. 268
"Cocking" . . . . . ii. 261
Colling . . . . . ii. 262, 263, 264
Collecting . . . . . ii. 260, 262
Collector . . . . . ii. 265
Crop . . . . . ii. 251
Crop from permanent grasses . ii. 287
Damaged . . . . . iii. 286
Early *v.* late stacking . . . ii. 269
Elevator . . . . . ii. 275
Experiments at Rothamsted . ii. 23
Feeding value of . . . . iii. 286
For feeding . . . . . ii. 254
Force in building stacks . . ii. 271
Form of stackhead . . . ii. 272
Foundations for stacks . . . ii. 270
Ground for stacks . . . ii. 268
Growing rye-grass seed . . ii. 278
Hand-rake . . . . . ii. 272
Heading stacks . . . . ii. 272
Height of stacks . . . . ii. 273
High-forking by hand . . . ii. 271
Horse-forks . . . . . ii. 274
House . . . . . i. 174
Ill-suited mixtures for . . . ii. 255
Injured by wet . . . . ii. 254
Large stacks . . . . ii. 273
Manuring the crop . . . ii. 251
Preparing for stacking . . . ii. 268
Process of building stacks . . ii. 271
" of turning . . . ii. 262
Propping stacks . . . . ii. 273
Raking . . . . . ii. 264
Racks for horses . . . . i. 172
Roping stacks . . . . ii. 272
Rotation . . . . . ii. 261
Sainfoin . . . . . ii. 370
Salting and spicing . . . ii. 277
For seed . . . . . ii. 253
Shed . . . . . ii. 270
v. silage . . . . . ii. 293

Hay—
Situation of field-stacks . . ii. 265
Size of staoks . . . . . ii. 271
Sledge . . . . . ii. 265
Stsck-lifters . . . . . ii. 273
Stacking . . . . . ii. 264
And etraw elevator . . . ii. 215
" mixed in drying . . ii. 269
Tedders injuring clover . . ii. 260
Tillage for . . . . . ii. 251
Time for cutting . . . . ii. 253
" for field-stacking . . ii. 264
Turning clover . . . . ii. 261
Varieties of . . . . . ii. 251
Yield of . . . . . ii. 253
Haymaking—
Artificial hay-drying . . . ii. 278
Clearing swathe ends . . . ii. 258
Controlled by weather . . . ii. 258
Cutting . . . . ii. 253, 257
Dressing etacks . . . . ii. 276
English methods of . . . ii. 259
Hay-fork . . . . . ii. 262
Hay-stacking appliances . . ii. 273
Head-ridges . . . . . ii. 258
Hot air *v.* Neilson system of drying ii. 278
Irish methods of . . . . ii. 276
Laid pstches . . . . . ii. 257
Loss in . . . . . iii. 286
Machines . . . . . ii. 259
"Making" the hay . . . ii. 258
Meadow-hay . . . . . ii. 259
Methods of cutting . . . ii. 256
Mower *v.* scythe . . . . ii. 256
Mowing-machines . . . . ii. 256
Permanent hay-stacks . . . ii. 270
Presser for hand-power . . ii. 279
Pressing hay . . . . . ii. 279
Rick-cloths . . . . . ii. 277
Scottish methods of . . . ii. 261
Speedy . . . . . ii. 260
By stages . . . . . ii. 269
In summer . . . . . ii. 63
Swathe-turning and tedding . . ii. 259
Thunderstorms and . . . ii. 263
Varistions in practice . . . ii. 258
Weather and . . . . . ii. 253
Headridges . . . . . i. 400
Heat . . . . . i. 25
Conductors of . . . . . i. 406
Dissipation of . . . . . i. 406
Economical use of . . . . i. 406
Evaporation and loss of, in drainage i. 46
Influence of . . . . . ii. 12
Preventing loss by radistion . i. 406
Source of energy . . . . i. 405
Heating, stack- . . . . . ii. 200
Heather-burning . . . . i. 343; iii. 383
Hedge-spade . . . . . i. 103
" weed-hook . . . . . i. 103
Hedger's axe . . . . . i. 97
Hedgers, duties of . . . . i. 7
" required for farms . . i. 8
Hedgehog, the . . . . . ii. 429
Hedges . . . . . i. 91
And wire fences . . . . i. 103
Breasting bank-and-ditch . . i. 97
Cutting down . . . . . i. 95
Dead . . . . . i. 101
Filling gaps . . . . . i. 100
Form of . . . . . i. 95
Growth of . . . . . i. 95
Hawthorn . . . . . i. 103
" plant . . . . . i. 92
Hedge-planters . . . . i. 92
Hedges—
Holly . . . . . i. 104
Injured by snow . . . . i. 95
Laying the plants . . . . i. 93
" young twigs . . . i. 101
Method of plashing . . . i. 98
Permanent fences . . . . i. 91
Planting . . . i. 91, 94, 100; ii. 66
Plashing . . . . . i. 98
Pruning . . . . . i. 95
Raising whin . . . . . i. 105
Stake-and-rice fence . . . i. 101
Switching . . . . . i. 95
Thorn, around plantstions . . i. 95
Time for planting . . . i. 91
Tools for planting . . . i. 91
" " weeding . . . i. 103
Transplanting thorns . . . i. 92
Trees and . . . . . i. 94
Trench-planting . . . . i. 91
Trimming . . . . . i. 96, 105
Turf fence . . . . . i. 103
Untrimed thorn . . . . i. 96
Waste of ground by . . . i. 89
Weeding . . . . . i. 103
Weeds . . . . . i. 94
Whin . . . . . i. 105
Hellriegel's discoveries regarding nitrogen ii. 47
Hemp culture . . . . . ii. 402
Herbs, aromatic . . . . . ii. 404
Herdwick sheep . . . . . iii. 197
Heredity in stock breeding . . . iii. 225
Hereford Cattle—
Characteristics . . . . iii. 97
Management . . . . . iii. 99
Milking qualities . . . . iii. 99
Polled . . . . . iii. 137
In the showyard . . . . iii. 99
Weights . . . . . iii. 99
Herring gull . . . . . ii. 441
Hessian fly . . . . . ii. 452
High pressure, steam . . . . i. 406
Highland and Agricultural Society—
Aid to agricultural education by . i. 36
Medals for ploughing . . . i. 388
Milk records . . . . . ii. 480
Table of unit values of manures . i. 507
Trials of steam-engines . . i. 418
Highland and Agricultural Society's manure experiments—
Cropping . . . . . ii. 33
Insoluble nitrogenous manures . ii. 36
Lessons from . . . . . ii. 39
Manures for the barley crop . ii. 37
" for the bean crop . . ii. 38
" for cereals . . . ii. 34
" for different crops . . ii. 40
" for oats . . . . ii. 38
" tried . . . . . ii. 33
" for turnips and beans . ii. 33
Manuring turnips . . . ii. 37
Object of the experiments . . ii. 33
Organic matter . . . . . ii. 40
Other research work . . . ii. 41
Results with nitrogenous manures ii. 35
" phosphatic manures ii. 34
" potash manures . ii. 37
The stations . . . . . ii. 33
Experiments with potatoes . . ii. 298
Highland cattle—
Characteristics . . . . iii. 116
Early improvement . . . iii. 118
Herd-Book Society . . . iii. 119
Management of the breed . . iii. 119
Points of the breed . . . iii. 117

Highland cattle, size and early maturity iii. 119.
Highland ponies . . . . . iii. 48
Early studs . . . . . iii. 49
Experiments with . . . . iii. 54
Management of . . . . . iii. 54
Origin . . . . . iii. 48
Points of . . . . . iii. 48
Resuscitation of . . . . iii. 48
Hill pasture—
Bracken-cutting . . . . i. 343
Cropping . . . . . i. 343
Deterioration of . . . . i. 343
Draining . . . . . i. 344
Effects of lime on . . . . i. 343
Glenbuck, improvements at . . i. 345
Heather-burning . . . . i. 343
Improvement of . . . . i. 343
Irrigation on . . . . . i. 343
Laying waste land to . . . i. 340
Liming . . . . . i. 343
Manuring . . . . . i. 343
Mid-Lothian example of improving i. 344
Renewing waste land . . . i. 340
Hiring farm-servants, methods of . i. 289
Histology . . . . . i. 14
Hives for bee-keeping . . . iii. 258
Hoar-frost . . . . . ii. 69
Hoe, barn . . . . . ii. 226
" Dutch . . . . . i. 103
Hoeing drilled wheat . . . . ii. 129
" hand-, beans . . . . ii. 152
" " potatoes . . . ii. 307
" horse-, beans . . . . ii. 152
" kohl-rabi . . . . . ii. 393
" singling and, turnips . . ii. 352
Hoggs, oats and hay for . . . iii. 396
Holly hedges . . . . . i. 104
Holstein churn . . . . . ii. 497
Homesteads, modern . . . . i. 139, 141
Homogenised milk . . . . ii. 483
Hooded crow . . . . . ii. 432
Hooding, for oats . . . . . ii. 187
" for wheat . . . . ii. 188
Hook, sickle or . . . . . ii. 169
Hook-stones, specification for . . i. 231
Hops—
Analysis of hops . . . . ii. 383
Cost of hop-cultivation . ii. 378, 384
Creasoting poles . . . . ii. 380
Culture . . . . . ii. 377
Dressing plants . . . . ii. 378
Drying hops . . . . . ii. 382
Harvesting hops . . . . ii. 381
Insect and fungoid attacks ii. 357, 381, 384
Longevity of the hop . . . ii. 381
Manuring . . . . . ii. 379
Picking . . . . . ii. 381
Planting hops . . . . . ii. 378
Pocketing . . . . . ii. 383
Preparing land . . . . ii. 377
Price of picking . . . . ii. 382
Produce of hops . . . . ii. 384
Rearing plants . . . . ii. 377
Soil for hops . . . . . ii. 377
Spent hops as manure . . . ii. 384
Stacking poles . . . . ii. 383
Tying up the bines . . . ii. 381
Varieties of . . . . . ii. 377
Horizontal engines . . . . i. 414
" condensing engine . . . i. 415
Horn as manure . . . . . i. 492
Horned breeds of Cattle . . . iii. 82
"Hornsby" binder . . . . ii. 177
Horse-beans . . . . . ii. 147
" breeding societies . . . iii. 10
Horse clippers . . . . . iii. 324
" bot-flies . . . . . iii. 419
" and cow dung compared . . i. 465
" fork . . . . . ii. 274
" -hoe . . . . . ii. 124
" " drill . . . . . ii. 352
" hoeing beans . . . . ii. 152
" -power in a stream . . . ii. 218
" " actual and "nominal" . i. 405
" " amount of fuel per . i. 405
" " "foot-pound" and . i. 405
" " for threshing purposes . ii. 221
" rake . . . . . ii. 260
Horses—
Administering medicine to . . iii. 496
Ailments of . . . . . iii. 438
Articles of food for . . . iii. 316
Barb-wire field-fences for . . i. 113
Binding . . . . . i. 174
Boxes for . . . . . i. 174
Breeding . . . . . iii. 315
Bulk of food . . . . . iii. 321
Care of . . . . . i. 293; iii. 321
Carrots and parsnips for . . iii. 319
Castration of . . . . . iii. 497
Clipping and singeing . . . iii. 323
Docking . . . . . iii. 498
Evening care of . . . . . iii. 314
Exercise for . . . . . iii. 315, 323
Feeding . . . . . iii. 316
Feeding young . . . . . iii. 320
Food requirements of . . . iii. 316
Food for riding and driving . . iii. 320
Foaling season . . . . . iii. 324
Force exerted by . . . . . iii. 317
Frequency of feeding . . . iii. 321
Furze for . . . . . iii. 319
Grooming . . . . . iii. 314
Handling young . . . . . iii. 315
Hay-racks for . . . . . i. 172
Hours of work . . . . . iii. 314
Injured by green food . . . iii. 323
Intelligence of . . . . . iii. 315
Language to . . . . . i. 381
Littering . . . . . iii. 323
Mashes for . . . . . iii. 318
Mating season . . . . . iii. 329
Measuring corn for . . . . i. 175
Method of stable management . iii. 324
Mid-day care of . . . . . iii. 314
Morning feed . . . . . iii. 313
Names suitable for farm . . iii. 330
Nomenclature of . . . . . iii. 330
Oats for . . . . . iii. 318
Pace and food requirement . . iii. 317
Pasturing work . . . . . iii. 321
Peculiarities in grazing . . . iii. 323
Period of gestation . . iii. 236, 499
Ploughing with . . . . . i. 380
Potatoes for . . . . . iii. 283
Preparing food for . . . . iii. 318
Protection of skin from wet . . iii. 324
Quantity of food . . . . . iii. 321
Rations for degrees of work . iii. 317, 320
Recipes for ailments of . . iii. 493
Rest for . . . . . iii. 323
Revolution in system of feeding . i. 172
Roots for . . . . . iii. 319
Shoeing . . . . . iii. 323
Singeing . . . . . iii. 323
Soiling . . . . . iii. 321
Speed of, in ploughing . . . i. 387
Stable equipment . . . . i. 167
Stalls for . . . . . i. 168
In summer, work for . . . . ii. 63

Horses—
Treatment of farm . iii. 313
Vetches for . ii. 368
Washing legs of . iii. 323
Water-brush . iii. 315
Watering . iii. 313
Winter feeding of . iii. 318
Wintering young . iii. 315
Wire-fence for . i. 115
Work expected of . iii. 314
Yoking to ploughe . i. 374
Horses, breeds of . iii. 2, 9
Cleveland Bay . iii. 32
Clydesdale . iii. 16
Foreign . iii. 61
Galloway . iii. 18
Hackney . iii. 37
The Hunter . iii. 36
Ponies . iii. 47
Shire . iii. 9
Suffolk . iii. 28
Thoroughbred . iii. 34
Yorkshire Coach-horse . iii. 33
House-fly . iii. 422
" -mouse . ii. 427
Houses for cattle, equipment of . i. 151
Housing calves . iii. 350
" of store cattle in winter . iii. 357
Howard's Champion Plough . i. 371
" haymaker . ii. 259
" mower . ii. 256
" self-delivery reaper . ii. 176
" straw-trusser . ii. 216
Hummellers . ii. 228
Humus . i. 303, 321, 434
Hunter horse . iii. 36
Management of . iii. 37
Method of breeding . iii. 36
Type . iii. 36
Hurdles . i. 116; iii. 391
Husbandry—
Good . i. 273
Mixed, needful . i. 437
Steadings for mixed . i. 136
Husk and kernel of oats . ii. 99
" " of wheat . ii. 95
Hussey reaping-machine . ii. 174
Hybridisation, Garton's work on . ii. 108
" progress of . ii. 109
Hydraulic ram . i. 153
Hygrophytes . i. 316
Hymenoptera, useful . ii. 469
Hyphomycetaceæ (fungi) . ii. 417

Identification of farm seeds . ii. 70
Implements, barn . ii. 225
" care of . i. 366
" house for . i. 367
" used in winter . ii. 67
Improvements, compensation for . i. 276
" executing permanent . i. 270
Impurities in clover and grasses . ii. 71, 244
In-and-in breeding . iii. 229
Incubators, use of . iii. 249
Indian corn as food for stock . iii. 272
Infield and outfield . i. 438
Inorganic chemistry . i. 13
" constituents of soil . i. 303
" matter available in soils . i. 304
" " in plants . i. 307
Insect enemies of live stock . iii. 417
" and fungoid attacks on hops . ii. 381
" attacks in summer . ii. 63
" " on turnips . ii. 326
" " lessened by drainage . i. 50
Insect pests. See Crop pests . ii. 442
" pests injurious to fruit . ii. 467
Insects, classification of . ii. 443
" harmful . i. 15
" important in agriculture . ii. 443
" useful . ii. 469
Insectivora . ii. 429
Insurance against fire, disease, &c. . i. 280
Insuring crops . i. 280
Inventory and valuation of stock . i. 244
Inverness-shire ponies . iii. 51
Invertebrates, classification of . i. 16
Ireland—
Agricultural education in . i. 36
Cattle-feeding in . iii. 370
Tenure in . i. 268
Wages of farm-servants in . i. 291
Irish Department of Agriculture . i. 40
Agricultural investigations . i. 43
Annual vote to . i. 41
Board and Council of . i. 42
Branches of . i. 42
Educational institutions . i. 43
Functions transferred to . i. 41
Funds . i. 42
Improvement of live stock . i. 43
Itinerant instruction and instructors i. 43, 44
Object of . i. 40
Organisation of . i. 42
Responsible officials . i. 41
Irish Hunters . iii. 36
" ponies, English and . iii. 41
Iron—
And wire fence. See Wire fences i. 114
Buildings . i. 228
Fences . i. 115, 117
Gates . i. 119
Harrowe . ii. 125
Hurdles . i. 116
Oxide of, in basic slag . i. 500
" in soils . i. 304
Scythes . ii. 171
Standards . i. 112
Strainers . i. 111
Trough . i. 151
Work, specification for . i. 236
Ironmongery, specification for . i. 243
Irons, plough . i. 384
Irrigation . i. 353
And drainage . i. 51, 355
And soil temperature . i. 355
Bed-work . i. 358
Catch-work water-meadow . i. 358
Climate and . i. 356
Cost of irrigating land . i. 360
Crop, Italian rye-grass an . ii. 376
Crops for . i. 356
Effects on the soil . i. 355
Liquid manure for . i. 359, 484
Moisture and vegetation . i. 354
Of hill pasture . i. 343
On hill-farms . iii. 400
Reasons for . i. 354
Regulating water-flow . i. 359
Sewage . i. 357
Side . i. 359
Soils for . i. 356
Swamp . i. 360
Systems of . i. 358
Time for . i. 356
Warping . i. 360
Water-meadow . i. 355
Water required for . i. 357
Winter . ii. 66
Island ponies . iii. 53

Italian rye-grass . . . . . ii. 376
Cabbages and . . . . ii. 372
Irrigation crop . . . . ii. 376
Produce . . . . . ii. 376
Seed . . . . . ii. 85, 376
Sowing for forage . . . . ii. 376
Itch mites . . . . . iii. 429
Ivel agricultural motor . . . i. 430

Jackdaw, the . . . . . ii. 434
Jack's farm cart . . . . . ii. 318
" potato digger . . . . ii. 317
" reaper and mower . . . ii. 257
Jar, cream . . . . . ii. 489
Jay, the . . . . . ii. 434
Jersey cattle—
Characteristics . . . . iii. 129
English Cattle Society . . . iii. 130
English improvers . . . iii. 130
Introduction into England . . iii. 129
Management of . . . . iii. 131
Milk and butter tests . . . iii. 130
Scale of points . . . . iii. 129
Johnson's ensilage press . . . ii. 292
Johnston on liquid manure . . i. 478
Joiner-work . . . . i. 232, 238, 242
Judges at ploughing-matches . . i. 389
Judging barley . . . . . ii. 97
" cheese, scale of points . . ii. 507
" land . . . . . i. 265
" of dryness in stacks . . . ii. 189
" ripeness of grain . . . ii. 168
" wheat . . . . . ii. 93

Kale, thousand-headed . . . ii. 374
Ked or louse-fly . . . . . iii. 424
Kent or Romney Marsh sheep . . iii. 156
Kerbs, specification for . . . i. 231
Kernel and husk of oats . . . ii. 99
" and husk of wheat . . . ii. 95
Kerry cattle—
As beef-producers . . . iii. 128
Characteristics . . . . iii. 127
Management . . . . iii. 128
Milking properties . . . iii. 128
The typical animal . . . iii. 126
Weights and measurements . . iii. 127
Kerryhill sheep . . . . . iii. 200
Kestrel, the . . . . . ii. 431
Key, iron hammer nut- . . . . i. 390
Kidney vetch . . . . . ii. 376
" seed of . . . . . ii. 77
"Kilns," stack, or bosses . . . ii. 265
Kirkwood's sheep fodder-rack . . iii. 394
Knapweed, seed of . . . . ii. 79
Knife, breasting . . . . . i. 96
Knife-sharpener for reaper . . . ii. 183
Knives for breaking cheese curd . . ii. 508
Knight, Mr, on cross-fertilisation of grain ii. 105
Knotter of self-binder . . . . ii. 78
Kohl-rabi . . . . . ii. 392; iii. 282

Labour—
Adjusting farm . . . . . i. 280
Books . . . . . i. 260
Distribution of farm . . . i. 2, 440
Force of, in reaping oats . . ii. 183
Good and bad management . . i. 280
For grain harvest . . . . ii. 169
Hours of, in summer . . . ii. 63
Persons who conduct farm . . i. 6
Rewards of . . . . . ii. 65
Rotation and . . . . . i. 437
Saving in, with self-binder . . ii. 181
Skilled, in drainage . . . i. 52
Labour, variety of farm . . . i. 2
Labourer's cottages. See Farm cottages i. 206
Classes of servants . . . i. 206
Residence on the farm . . . i. 207
Specification of . . . . i. 241
Labourers for working reaper . . ii. 175
Lactocribe . . . . . ii. 479
Ladders . . . . . ii. 222
Ladybirds . . . . . ii. 469
Lambing—
After . . . . . iii. 379
Assistance in . . . . iii. 377
Assisting in feeding . . . iii. 378
Cleaning ewes' udders . . . iii. 379
Hardiness of hill sheep . . iii. 377
Hospital . . . . . iii. 377
Inflammation after . . . iii. 378
Look to the pastures . . . iii. 380
Mothering lambs . . . . iii. 378
Pens . . . . . iii. 377
Period of . . . . . iii. 379
Season . . . . . iii. 377
Shepherd's hut . . . . iii. 377
Supplementary shelter . . . iii. 377
Lambs—
After-treatment . . . . iii. 386
Ailments among . . . . iii. 380
Assistance in feeding . . . iii. 378
Carrying . . . . . iii. 379
Castration of . . . . iii. 379, 498
Cow's milk for . . . . iii. 378
Docking . . . . . iii. 379
Drafting . . . . . iii. 386
Fattening . . . . . iii. 386
Removing ewes from . . . iii. 378
"Rig" or "chaser" . . . iii. 380
Risks from castration and docking iii. 380
Shearing . . . . . iii. 385
Shepherding hill sheep . . iii. 380
Stimulants for weak . . . iii. 379
Treatment of ewes and . . iii. 386
Twins and abortion . . . iii. 381
Weaning . . . . ii. 63; iii. 386
Lancashire boiler . . . . i. 408
" cheese . . . . ii. 513
Land—
Burdens . . . . . i. 276
Chalking . . . . . i. 348
Claying . . . . . i. 346
Cost of irrigating . . . . i. 360
Draining . . . . . i. 44
Improving poor and waste . . i. 335, 340
Irrigating . . . . . i. 353
Judging . . . . . i. 265
Levelling . . . . . i. 338
Liming . . . . . i. 360
Marling . . . . . i. 348
Paring and burning . . . i. 349
Re-draining . . . . . i. 74
Rollers . . . . . ii. 142, 143
Rolling . . . . . ii. 141
Value, local climate and . . i. 264
" rent and . . . . i. 269
Warping . . . . . i. 360
Wet clay . . . . . i. 50
Language to horses . . . . i. 381
Lapwing, the . . . . . ii. 440
Large black pig . . . . . iii. 214
" white pig . . . . . iii. 210
" white Ulster pig . . . iii. 212
Lark, the . . . . . ii. 440
Lath and plaster work . . i. 240, 244
Laval cylindrical milk-cooler . . ii. 483
Lavender . . . . . ii. 402
Laverock, the . . . . . ii. 440

Law of farm service. See Farm service i. 294
Lawes on high-pressure and profitable feeding . . . . . iii. 364
" and Gilbert's manurial tables . iii. 304
Lawrance flat cooler for milk . . ii. 483
Laying out a farm . . . . . i. 22
" out roads . . . . . i. 123
Lazy-bad system of planting potatoes ii. 310
Lease. See also Tenancy . . . . i. 267
Adventurous offerers . . . . i. 271
Care in drafting conditions . . i. 272
Compensation for improvements . i. 276
Conditions as to manuring . . i. 275
" as to weed-cleaning . i. 275
" of . . . . i. 271
" of cropping . . i. 273
Disposal of produce . . . i. 275
Entering a farm . . . . i. 277
Essential repairs . . . . i. 270
Feudal customs . . . . i. 276
Game restrictions in . . . i. 272
Land burdens . . . . i. 276
Leaving the farm in rotation . i. 275
Owners' rights reserved . . i. 272
Penal clauses . . . . i. 276
Provisions as to cropping . . i. 275
Record of holding . . . i. 277
Rent-day . . . . . i. 272
Stamping the . . . . i. 273
Ledger . . . . . i. 249
Leaks . . . . . ii. 398
Leguminous crops and soil nitrogen . i. 435
" enrich soil with nitrogen . i. 324
" plants . . . . . ii. 146
" seeds . . . . . ii. 74
Leicester sheep—
Bakewell's influence . . . iii. 138
Characteristics . . . . iii. 139
Clip and weight . . . . iii. 139
Locality . . . . . iii. 139
Management of . . . . iii. 139
Leicestershire cheese . . . . ii. 512
Lens, examination of seed by pocket- ii. 70
Lentils as food for stock . . . iii. 273
" vegetable casein . . . iii. 273
Level, Challoner's . . . . i. 67
Levelling-box . . . . . i. 338
" dyke-top . . . . . i. 108
" land . . . . . i. 338
" staff . . . . . i. 67
Lice, general treatment of plant- ii. 444
" biting . . . . . iii. 426
" blood-sucking . . . . iii. 425
" treatment for . . . . iii. 427
Lifter, sack- . . . . . ii. 229
Light, comparative duration of, in seasons ii. 62
" influence of . . . . . ii. 12
Lime—
Action of . . . . . i. 361
And drainage water . . . i. 362
And nitrifying organisms . . i. 361
And soluble phosphates . . i. 362
Application of . . . . i. 360
As a preventive of crop disease . i. 362
Benefits from . . . . i. 361
Burning . . . . . i. 363
Characteristics . . . . i. 366
Composition of . . . . i. 366
" phosphate of . . i. 501
" slaked . . . . i. 364
Compost . . . . . i. 366
Covering in . . . . . i. 365
Dissipating plant-food . . . i. 361
Durable effects of . . . . i. 363
Effects of, on grass land . . i. 362
Lime—
Effects of, on hill pasture . . i. 343
Essential in burning land . . i. 350
For hill pasture . . . . i. 363
For sandy soils . . . . i. 362
Gas . . . . . i. 366, 505
Ground . . . . . i. 364
In soils . . . . . i. 330
Limeshells . . . . . i. 363
Loving crops . . . . i. 362
Over-use of . . . . . i. 361, 363
Quantity per acre . . . i. 365
Shovel . . . . . i. 513
Slaking . . . . . i. 364
Sources of . . . . . i. 360
Specification for . . . . i. 231
Spreading . . . . . i. 364
Time for applying . . . i. 361
Weight of . . . . . i. 365
Limestone, composition of . . . i. 365
" ground . . . . . i. 364
Lime-washing, specification for . . i. 236
Liming . . . . . i. 360
Care of men and horses . . i. 365
Frequent . . . . . i. 365
Hill pasture . . . . i. 343, 344
Injury from imprudent . . i. 361
Land . . . . . i. 360
Lincoln long-wooled sheep—
Characteristics . . . . iii. 148
Management of . . . . iii. 149
Modern Records . . . . iii. 148
Noted early flocks . . . iii. 148
Lincolnshire, Curly-Coated pigs . . iii. 215
Lincolnshire Red Shorthorn—
Characteristics . . . . iii. 95
Early improvement . . . iii. 94
Later improvement . . . iii. 94
Management . . . . iii. 96
Milking qualities . . . . iii. 96
Weights . . . . . iii. 95
Line-breeding . . . . . iii. 229
Linnet, the . . . . . ii. 439
Linseed for calves . . . . iii. 275
" for foals . . . . . iii. 328
" as food for stock . . . iii. 274
Linseed-cake, reputation of . . iii. 275
Liquid manure. See also Urine . . i. 475
Acts quickly . . . . i. 479
Advantages of . . . . i. 479
Application by cart . . . i. 483
Average composition of . . i. 479
Carts . . . . . i. 483
Complex character of excreta . i. 475
Composition and character of . i. 475
Compost with . . . . i. 484
Disadvantages of excess of water . i. 479
Dispensing with pumps . . i. 481
Drain . . . . . i. 159
Drainings from yard and dung-heaps i. 478
Irrigation with . . . i. 359, 484
Johnston on . . . . . i. 478
Mid-Lothian system of collecting i. 481
Neglect of . . . . . i. 480
Preventing loss of ammonia . . i. 485
Pump . . . . . i. 160, 481
Rainfall and loss of . . . i. 480
Scoop . . . . . i. 484
Tanks . . . . . i. 159, 480, 481
Time for application . . . i. 486
Utilisation of surplus . . . i. 482
Valuable character of . . . i. 477
Variation in its composition . i. 477
With the dung . . . . i. 481
Literature of entomology . . . ii. 471

Litter—
Careless strewing of, in courts . i. 457
Saving of, in cattle courts . . i. 162
Littering horses . . . . . iii. 323
Live stock—
Accounts . . . . . i. 256
Ailments of . . . . . iii. 435
Damaged wheat for . . . . iii. 269
Farm . . . . . iii. 1
In farm buildings . . . . i. 129
Insect enemies of . . . . iii. 417
Insurance of, against fire . . i. 280
Marketing of, and dead meat . iii. 407
Quantities of dung from . . i. 466
Rotation and . . . . i. 436
Scheme for improvement of, in Ireland i. 43
Weighbridge . . . . iii. 410
Loading a cart with sacks . . . ii. 229
Loamy soil . . . . . i. 298
Loans for draining . . . . i. 46
Locks, specification for . . . i. 239
Locomotive, agricultural . . . i. 419
Locust or carob beans . . . . iii. 278
Loft floor, specification for . . . i. 234
Long-horned cattle . . . . iii. 136
Long-wooled breeds of sheep . . iii. 138
Lonk sheep . . . . . iii. 197
Lucerne . . ii. 49, 76, 355, 369; iii. 289
Lupin, cultivation of . . . . iii. 274

M'Ainsh-Robertson grain-drying rack ii. 208
M'Cormick's reaping-machine . . ii. 174
Machine-draining, early attempts at . i. 79
Machine-sowing of oats . . . ii. 137
Maggot, mangold-leaf . . . . ii. 446
Maggot-fly, sheep . . . iii. 383, 423
Magpie, the . . . . . ii. 434
Main posts, specification for . . i. 232
Maize . . . . . ii. 376; iii. 272, 288
Malleable-iron fence . . . . i. 118
" straw-rack . . . . . i. 152
Malt as food for stock . . . iii. 270
" Rothamsted experiments with . iii. 270
Malt-combs as food for stock . . iii. 271
" as manure . . . iii. 271
Malting barley . . . . . ii. 97
Mammals in relation to farm life . ii. 424
Management of cows and calves . . iii. 330
" of flocks . . . . . iii. 376
" of pastures . . . . . ii. 280
" of store and fattening cattle . iii. 355
Manganese, oxide of, in soils . . i. 304
Mange, itch, or scab mites . . . iii. 429
Mangels . . . . . ii. 362
Advantages of storing . . . iii. 281
Autumn tillage . . . . . ii. 363
Beetle . . . . . ii. 446
Carting roots . . . . . ii. 367
Climate for . . . . . ii. 363
Cover with dry straw . . . ii. 366
Cultivation for . . . . ii. 363
Dependency on manure . . . ii. 365
Drills and flat rows . . . ii. 363
Dung for . . . . . ii. 365
Experiments at Rothamsted . ii. 28, 364
Experiments with (R. A. S. E.) . ii. 49
As food . . . . . iii. 281
After hoeing . . . . . ii. 366
Ingredients absorbed by . . . ii. 364
" of manure for . . . ii. 364
Injuring plants . . . . . ii. 366
Maggot . . . . . ii. 446
Manuring . . . . . ii. 364
Medium *v.* large roots . . . iii. 281
Plagues . . . . . ii. 366
Mangels—
Preliminary cleaning . . . ii. 366
Quantity of seed . . . . ii. 364
Salt for . . . . . ii. 364
Soils for . . . . . ii. 363
Storing . . . . . ii. 366
Sugar in . . . . . iii. 280
Thinning and after cultivation . ii. 366
Time of sowing . . . . ii. 364
Transplanting . . . . ii. 366
Varieties of . . . . . ii. 362
Yield of . . . . . ii. 366
Mangers . . . . . i. 155
And racks, metal . . . . i. 172
Fire-clay . . . . . i. 173
Specification for . . . . i. 232
" for stable . . . i. 235
Support for . . . . . i. 173
Manual and self-delivery machines . ii. 176
Manures and manuring . . . i. 446
Abstraction of fertility . . i. 447
Action of nitrogen greatest on young plants . . . . i. 493
Advantages of sowing each, separately i. 509
And mutton experiments . . i. 346
Apatite, phosphorite, and phosphatic layers . . . . i. 498
Application of . . . . i. 511
" of artificial . . i. 515
Artificial and special . . i. 486
Bare fallow . . . . . i. 445
Barley . . . . . ii. 133, 134
" Yorkshire trials in . . ii. 135
For beans . . . . . ii. 149
Beans and nitrogenous . . . ii. 149
Cabbages . . . . . ii. 372
For carrots . . . . . ii. 394
Carting in winter . . . . ii. 67
For cereals . . . . . ii. 7
Character of soil and . . . i. 516
Characteristics of nitrogenous . i. 490
Chemical analysis unreliable . i. 449
" process in mixing . . i. 508
Choice of phosphatic . . . i. 503
Compound . . . . . i. 505
Compounding mixtures . . . i. 510
Conditions in lease . . . i. 275
Conserving, in soils . . . i. 492
Covered-court, for potatoes . . i. 166
Dangers of careless mixing . . i. 508
Deferring exhaustion . . . i. 448
Different rotations . . . i. 518
" soils . . . . i. 516
Distributor . . . . . i. 520
Drainage and economical . . i. 51
Effect of phosphatic, in soils . i. 328
Elements to be supplied in . . i. 516
Estimating the value of . . i. 508
Evidence of the crops . . . i. 450
" " soil . . . i. 517
Excessive nitrogenous applications i. 491
Exhaustion in a Norfolk rotation i. 448
" and restoration of fertility i. 447
Experiments in Aberdeenshire with ii. 51
" by Highland and Agricultural Society . ii. 33
" at Rothamsted . ii. 28
" by Royal Agricultural Society of England ii. 42
Farmers' experiments in . . i. 452
Fermentation in the dung . . i. 166
"Fire-fang" in open-court dung . i. 167
Flax . . . . . ii. 387
For slow and fast growing crops . i. 517
Form of application for different soils i. 516

Manures and manuring—
Green . . . . . i. 445
The hay crop . . . . . ii. 251
Hill pasture . . . . . i. 343
Home mixing preferable . . i. 511
Hops . . . . . ii. 379
" experiments in . . . ii. 380
Increased value of, in cattle-courts . i. 161
Ingredients removed by crops . i. 448
Knowledge of geology useful . i. 516
Kohl-rabi . . . . . ii. 393
Law of minimum . . . . . i. 453
Lesks . . . . . ii. 398
Loss in, by washing . . . i. 166
Malt-combs as . . . . . iii. 271
Mangels . . . . . ii. 364
Meadows, English trials in . . ii. 252
Method of test experiments . . i. 451
Methods of mixing . . . i. 509
Mixtures injured by lying long . i. 509
" and mixing . . . i. 508
More frequent . . . . . i. 518
Nitrogenous, which enrich the soil i. 325
For oats . . . . . ii. 138
Pastures . . . ii. 281, 282, 283, 287
Potash . . . . . i. 329
Potatoes . . . . . ii. 297
" College trials in . . ii. 301
Power of soils to retain . . i. 492
Preventing "fire-fang" in . . i. 166
Purchasing of . . . . . i. 505
Quantity of, per head . . . i. 161
Rainfall and artificial . . . i. 518
" and time of sowing . . ii. 10
Ratio of different ingredients . i. 519
Removal and return of plant-food i. 449
Residues of previous . . . ii. 13
Resources of the soil to be reckoned i. 449
Restoration of fertility of soil by . i. 328
Restoring fertility . . . i. 448
Retention of . . . . . i. 329
Return from, on exhausted land . i. 517
Safe mixtures . . . . . i. 509
Slow and active . . . . i. 490
" for slow-growing crops . i. 492
Soil, climate, and . . . . i. 518
Soluble phosphates or superphosphates . . . . . i. 501
Sowing, by machines . . . i. 520
" in drills . . . . i. 519
Spent hops as . . . . . ii. 384
Successful . . . . . i. 449
Supplemented . . . . . i. 514
Surface . . . . . i. 515
Tillage and . . . . . i. 517
Time of application of artificial . i. 519
Top-dressing, in summer . . ii. 63
Turnip-tops as . . . . . ii. 358
Turnips . . . . . ii. 339
Uncertain character of compound i. 510
Unit value of . . . . . i. 507
Valuable ingredients of . . i. 507
Valuation of unexhausted . . i. 330
Value and uses of experiments . i. 517
Vetches . . . . . ii. 369
Wheat . . . . . ii. 128
Manures, varieties of . . . i. 453, 475, 486
"Alta Vela" phosphates . . i. 499
Ammonia, sulphate of . . . i. 490
Apatite . . . . . i. 498
Basic slag . . . . . i. 499
Blood, dried . . . . . i. 488
Bones . . . . . i. 493
Calcium cyanamide . . . i. 489
Coprolites . . . . . i. 497
Manures, varieties of—
Dissolved guano . . . . i. 488
Farmyard . . . . . i. 453
Fish guano . . . . . i. 486
Frey Bentos guano . . . i. 487
Gas-lime . . . . . i. 505
Guano, dissolved . . . . i. 488
" fish . . . . . i. 486
" Frey Bentos . . . i. 487
" Peruvian . . . . i. 486
" rock . . . . . i. 499
Gypsum . . . . . i. 504
Horn . . . . . i. 492
Lime . . . . . i. 360
Liquid . . . . . i. 475
Mineral phosphates . . . i. 502
Nitrate of potash . . . . i. 489
" of soda . . . . i. 488
Nitrogenous . . . . . i. 490
Peruvian guano . . . . i. 486
Phosphatic . . . . . i. 493
Phosphorits . . . . . i. 498
Potassic . . . . . i. 503
Rape-dust . . . . . i. 488
"Redonda" phosphates . . i. 499
Rock guano . . . . . i. 499
Shoddy . . . . . i. 488
Soda, nitrate . . . . . i. 488
Soot . . . . . i. 491
Sombrero . . . . . i. 499
Sulphate of ammonia . . . i. 490
Superphosphates . . . . i. 501
Manure-trade, origin of the . . i. 497
Manurial constituents in 1000 lb. of ordinary foods . . . . i. 329
" elements in rain-water, loss of . ii. 16
" residue of foods . . . . i. 329
" value of cotton-cake . . iii. 277
" " of straw . . . . i. 467
Manurial value of foods . . . iii. 303
Lawes and Gilbert's tables . . iii. 304
Proportion of food assimilated and voided . . . . . iii. 304
Solid excreta . . . . . iii. 304
Theoretical and realised manure values . . . . . iii. 310
Unexhausted value of consumed food . . . . . iii. 310
Urine . . . . . iii. 304
Voelcker and Hall's tables . . iii. 311
Mares, abortion in . . . . . iii. 324
" number of, to one stallion . iii. 329
" period of gestation . . iii. 236
Market-gardening . . . . . ii. 397
Marketing grain in winter . . . ii. 67
" of dairy produce . . . iii. 409
" honey . . . . . iii. 258
" of live stock and dead meat . iii. 407
" of meats . . . . . iii. 414
" poultry . . . . . iii. 251
Marking sheep . . . . . iii. 386
Marl clay, composition of . . . i. 349
" shell, composition of . . i. 349
Marling land . . . . . i. 348
Marshall's agricultural motor . . i. 430
Martinmas entry to farms . . . i. 277
Martin's cultivator . . . . ii. 331
Martins, swallows and . . . ii. 437
Masham sheep . . . . . iii. 204
Mason-work, specification for . . i. 236-241
Mating season of horses . . . iii. 329
Mattock . . . . . i. 337
Maunds or wechts . . . . . ii. 225
Mavis, the . . . . . ii. 436
Meadow catstail, seed of . . . ii. 84, 239

Meadow fescue, seed of . . . ii. 85
" foxtail, seed of . . . . ii. 83
" grasses, seeds of . . . . ii. 87
" manuring . . . . . ii. 251
Meadows—
English trials in manuring . . ii. 252
For highland districts . . . i. 355
Water- and irrigation . . . i. 355
Water catch-work . . . i. 358
Meal, yield of . . . . . ii. 100
Meals, compound cake and . . iii. 287
" for store cattle . . . iii. 361
Mean and actual temperature . . i. 261
" temperature, rise of Greenwich . i. 26
Measuring grain . . . . . ii. 227
" water-supply . . . . ii. 217
Meat-flies, blue-bottles or . . . iii. 423
Meats, marketing of . . . iii. 413, 414
Mechanical engineering . . . i. 22
Mechanics . . . . . i. 20
" applied . . . . . i. 22
" of the plough . . . . i. 373
Medals for ploughing-matches . . i. 388
Medicine, administering . . . iii. 496
Memorandum book . . . . i. 260
Mendel's laws in improving grain . ii. 110
" " in stock-breeding . iii. 231
Mericarps . . . . . ii. 80
Merino sheep . . . . . iii. 205
Metabolism . . . . . iii. 296
Metal mangers and racks . . . i. 172
" important to farmers . . . i. 12
" size of, for roads . . . . i. 124
Metazoa, classification of . . . i. 16
Meteorology . . . . . i. 20
Mice . . . . . ii. 427
Micro-organisms in soil . . . i. 325
Microbe of cattle abortion . . . iii. 337
" of sheep abortion . . . iii. 337
Microscope, inspecting seeds by the . ii. 70
Middle white pig . . . . . iii. 211
Mildewe, the . . . . . ii. 411
Milfoil, seed of . . . . . ii. 79
Milk . . . . . ii. 478
Albumen . . . . . ii. 480
Appliances for weighing . . ii. 480
Bottles . . . . . ii. 482, 485
Butter-fat . . . . . ii. 478
For calves . . . . . ii. 486
Casein . . . . . ii. 479
Churning whole- . . . . ii. 495
Cleaning dairy utensils . . ii. 486
Cold store . . . . . ii. 483
Composition of cow's . . . ii. 478
" of, from different breeds . ii. 478
" of separated . . . iii. 352
Condensed . . . . . ii. 484
Consumption and selling of whole- ii. 485
Coolers . . . . . ii. 483
Co-operative depots . . . ii. 485
Destination of . . . . . ii. 484
Fat-globules . . . . . ii. 479
Filter . . . . . ii. 488
As food . . . . . iii. 269
Homogenised . . . . . ii. 483
Laval cylindrical cooler . . ii. 483
Lawrence flat cooler . . . ii. 483
Methods of distribution . . ii. 485
Pan, iron . . . . . ii. 488
Pasteurisation of . . . . ii. 481
Pasteuriser tin can . . . ii. 481
Purifying and preserving . . ii. 481
Railway churn or can . . . ii. 485
Records . . . . . ii. 480
Refrigerating machines . . ii. 484
Milk—
Selling skim- . . . . . ii. 492
Selling trade . . . . . ii. 485
Separated . . . . . ii. 492
" for calves . . . . iii. 352
Shelves . . . . . ii. 476
Sieve . . . . . ii. 488
Statistics . . . . . ii. 480
Sterilisation of . . . . ii. 482
Substitutes for calf-rearing . iii. 350
Sugar . . . . . ii. 480
Testing percentage of cream . ii. 479
Turbine-driven pasteuriser . ii. 481
Vat . . . . . ii. 502
Weight and specific gravity . ii. 480
Zinc dishes unsuitable for . ii. 488
Milkhouse . . . . . i. 190
" vertical section of . . . i. 197
Milk-yield, ventilation and temperature on . . . . . iii. 346
Milking cows . . . . . iii. 340
Cows holding back milk . . iii. 341
Hours of . . . . . iii. 340
Improved system of . . . iii. 342
Machines for . . . . . iii. 342
Milk-pails . . . . . iii. 340
Milking side . . . . . iii. 341
Nisvling . . . . . iii. 341
Operation of . . . . . iii. 341
Percentage of butter-fat . . iii. 340
Period of . . . . . iii. 340
Spaying . . . . . iii. 343
Stripping . . . . . iii. 341
Udder of . . . . . iii. 340
Milking-stool . . . . . iii. 341
Mill-dam . . . . . ii. 218
Mill-wheel arc, specification for . . i. 238
Milling properties of oats . . . ii. 140
Mineral constituents, the fate of . . ii. 17
" manures for barley . . . ii. 20
" theory at Rothamsted . . ii. 5
Minerals, specific gravity of . . i. 24
Minimum thermometer . . . i. 26
Missel-thrush, the . . . . ii. 436
Mites, acarina or . . . . iii. 427
Mixed farm, extent of a . . . i. 6
" husbandry, steadings for . . i. 136
Mixing manures . . . . . i. 508
Mixtures, standard seed . . . ii. 246
Modern British cattle . . . iii. 6
" reaping-machines . . . ii. 174
" Scotch plough . . . . i. 370
Moisture and germination . . . ii. 155
" and vegetation . . . i. 354
" in irrigation . . . . i. 354
Molasses as food. See Treacle . . iii. 278
Mole, the . . . . . ii. 429
Mole-drains . . . . . i. 74
" v. core-drains . . . i. 84
Money-rents, fixed . . . . i. 269
Moorland breeds of sheep . . iii. 183
Morgan's hay- and straw-press . ii. 279
Morphology . . . . . i. 14
Mortar, specification for . . i. 231, 236, 241
Mossy land, insoluble phosphates for . ii. 35
Moths—
Cabbage . . . . . ii. 447
Death's-head . . . . ii. 462
Diamond-back . . . . ii. 464
Heart or dart . . . . ii. 465
Magpie . . . . . ii. 468
Pea . . . . . ii. 460
Raspberry . . . . . ii. 467
Turnip . . . . . ii. 465
Motive power for threshing-machines . ii. 216

Motor, harvesting by . . . . ii. 182
" driven pasteurisers . . . . ii. 482
Motors, agricultural . . . . i. 430
Mountain or moorland breeds of sheep iii. 183
Mowers, types of . . . . ii. 256
Mowing-machines. See Reaping-machines ii. 256
Mule, the, and the Ass . . . iii. 59
" breeding . . . . . iii. 60
Mull ponies . . . . . iii. 53
Multiple fruits . . . . . ii. 82
Mustard . . . . . ii. 73, 375
Myxomycetes . . . . . ii. 417

Names for horses . . . . iii. 330
Natural drainage . . . . i. 51
" history . . . . . i. 15
" orders of plants . . . . i. 14
" philosophy . . . . . i. 19, 22
Needle of self-binder . . . . ii. 178
Neilson system of drying hay . . ii. 278
Nelson system of drying grain . . ii. 202
Nets for enclosing sheep . . . iii. 391
Neufchatel or Bondon cheese . . ii. 521
Newberry's dibbling-machine . . ii. 163
New Forest pony . . . . iii. 44
Newington's dibbling-machine . . ii. 164
Nievling . . . . . iii. 341
Nipplewort, seed of . . . . ii. 80
"Nitragin" . . . . . i. 324
Nitrate of potash . . . . . i. 489
Nitrate of soda . . . . . i. 488
Action of . . . . . i. 491
And sulphate of ammonia compared i. 491
As a manure . . . . . i. 329
Nitrates in drainage-waters, loss of . ii. 15
Fallowing and loss of . . . i. 441
Production of, in soils . . . i. 321
Vegetation preventing the loss of i. 473
Nitre-beds, forming . . . . . i. 489
Nitric acid in bare fallow, production of i. 442
Nitrification and drainage . . . i. 49
" of soil . . . . . i. 311
" theory of . . . . . i. 489
Nitrifying organisms, lime and . . i. 361
Nitrogen, per 10,000 lb. of soil . . i. 323
Action of, on young plants . . i. 493
And sulphuric acid from rain-water i. 48
Annually lost from dung . . i. 454
Artificial supply essential for wheat ii. 7
Ash constituents and, in 1000 lb. of various animals . . . i. 328
Cold weather and loss of . . . i. 473
In dung . . . . . ii. 5
Grass and soil . . . . . i. 434
In soils . . . . . i. 320
Leguminous crops and soil . . i. 435
Leguminous crops enrich soil with i. 324
Loss and conservation of . . i. 435
Methods of preserving, in dung . i. 459
Natural restoration of, to arable soils ii. 16
" supplies of ash and . . ii. 8
For potatoes . . . . . ii. 298
Of the soil and atmosphere insufficient ii. 6
For turnips . . . . . ii. 341
Utilisation of air, by plants . . i. 332
Nitrogenous manure, beans and . . ii. 149
" " for barley crop . ii. 19, 37
" " experiments . ii. 35
" " characteristics of i. 490
" " which enrich the soil i. 325
Nomenclature of horses . . . iii. 330
" of pigs . . . . . iii. 224
" of sheep . . . . . iii. 403
Norfolk sheep . . . . . iii. 203
Norwegian harrow . . . . . ii. 386

Nutlets . . . . . ii. 81
Nut-key, iron hammer . . . . i. 390
Nutrition, animal . . . . iii. 291
Nutritive value of roots . . . iii. 279
" value of sugar-beet . . . iii. 281

Oatmeal balls for cattle . . . iii. 369
" nutriment in . . . iii. 272
Oats . . . . . ii. 98
Antiquity of culture of . . ii. 100
Bad work in binding . . . ii. 184
And barley mixed . . . . ii. 138
Bruising . . . . . iii. 272
Classification . . . . . ii. 98
Crop values . . . . . ii. 90
Cutting . . . . . ii. 183
As food for stock . . . ii. 100; iii. 272
Force of labour in reaping . . ii. 183
Grains in a bushel of . . . ii. 99
Harrowing . . . . . ii. 136
And hay for hoggs . . . . iii. 396
For horses . . . . . iii. 318
Influence of season on . . . ii. 139
Kernel and husk of . . . ii. 99
Limits of culture of . . . ii. 101
Machine sowing . . . . . ii. 137
Manuring . . . . . ii. 38, 138
Meal . . . . . ii. 99
Milling properties of . . . ii. 140
New and old varieties compared . ii. 140
Number of seeds per acre . . ii. 137
Origin of . . . . . ii. 101
Ploughing for . . . . ii. 137
Preparing to cut . . . . ii. 182
Quantity of seed . . . . ii. 137
Raking . . . . . ii. 184
Reaping . . . . . ii. 182
Riddle . . . . . ii. 225
Seed of golden oat . . . ii. 88
" of tall oat grass . . . ii. 84
Sharp knives for cutting . . ii. 182
Smut of . . . . . ii. 416
Soil and milling property of . ii. 141
Sowing . . . . . ii. 136, 138
Stack-heating . . . . . ii. 200
Straw . . . . . ii. 103
Summer culture of . . . ii. 139
Tulip root of, or segging . . ii. 471
Varieties of . . . . . ii. 136
Water-furrows after sowing . . ii. 137
Welsh trials in manuring . . ii. 138
Yield and weight . . . . ii. 90, 99
Offering for a farm . . . . i. 270
Oilcake breaker . . . . . iii. 396
Oilcakes, minor . . . . . iii. 277
Oil-can . . . . . ii. 223
Oil-engines, working of . . . i. 429
" and gas-engines . . . i. 428
Old English drains . . . . i. 57
Oliver's chilled plough . . . i. 372
Onions . . . . . ii. 398
" fly . . . . . ii. 459
" mildew . . . . . ii. 411
Orchards . . . . . ii. 400
Orders, Natural, of plants . . . i. 14
Organic chemistry . . . . i. 13
" matter in soils . . . . i. 302
" manures unnecessary for cereals ii. 6
Orkney and Shetland cattle . . iii. 136
Ornamental wire field-fencing . . i. 116
Otter, the . . . . . ii. 426
Otto gas-engine . . . . . i. 428
Outfalls . . . . . i. 52, 53
Outfield and infield . . . . i. 438
Outhouses of cottages . . . . i. 226

Outlets for porous drains . . i. 82
Oversbot method of water-wheel . ii. 220
Owls . . . . . ii. 431
Ox-warble fly . . . . . iii. 420
Oxen, comparative value of foods for . iii. 300
Oxford Down sheep . . . . . iii. 174
Oxidation in different soils . . . i. 325
Oxide of calcium . . . . . i. 360
" of iron in basic slag . . . . i. 500
" of iron in soil . . . . . i. 304
" of manganese in soils . . . i. 304
Oxygen and carbonic acid in the air . i. 49
" and combustion . . . . . i. 404

Paddocks, grass . . . . . i. 89
" for sheep . . . . . iii. 401
Pail, milk- . . . . . iii. 340
Painting, specification for . . i. 236, 240, 243
Paling, common wooden . . . . i. 102
Palm-nut meal as food for calves . iii. 277
Pansy, seed of fisld- . . . . . ii. 75
Paper-making, flax straw for . . ii. 391
Paraffin emulsion, how to make . . ii. 444
Parasites in seeds . . . . . ii. 72
" seeds of . . . . . ii. 89
Paring and burning land . . . i. 349
Paring-plough . . . . . i. 351
" sock . . . . . i. 351
Parkes's system of drainage . . i. 45
Parks, letting grass, in spring . . ii. 59
Parmesan or Grana cheese . . . ii. 517
Parsley, seed of . . . . . ii. 80
Parsnips . . . . . ii. 396, 398
" fly . . . . . ii. 449
" as food . . . . . iii. 282
" for horses . . . . . iii. 319
" leaves as food for cows . . ii. 397
" seed of . . . . . ii. 80
" storing . . . . . ii. 396
Partridge, the . . . . . ii. 441
Pasteurisation of milk . . . . ii. 481
Pasteurisers, belt-driven . . . ii. 482
" motor-driven . . . . ii. 482
" turbine-driven . . . . ii. 481
Partitions, specification for . . i. 239, 242
" swung bale *v.* travis . . . i. 169
Pastoral and arable farming, steadings for i. 132
" compact, steading . . . i. 131
Pastoral farm—
  Cropping . . . . . i. 276
  Flying stock on . . . . . i. 4
  Rent of . . . . . i. 4
  Sheds for sheep on . . . i. 132
  Steadings for . . . . . i. 130
  Stocking . . . . . i. 4
  Wintering sheep on . . . . iii. 399
Pastoral farmer, knowledge required by i. 5
Pastures—
  Application of manures . . ii. 283
  Clifton Park system of growing . ii. 287
  On different soils . . . . ii. 280
  Drainage of . . . . . ii. 281
  Drainage improving . . . i. 50
  Drains and fences . . . ii. 284
  Dressings of manures . . ii. 282
  Effect of climate on . . . ii. 280
  Elliot's, Mr, seed mixture for . ii. 288
  "Fairy rings" in . . . . ii. 287
  Feeding cake on . . . . ii. 282
  Formation of permanent . . ii. 285
  Grass, analysis of . . . . ii. 394
  Grasses and clovers for permanent ii. 245, 285
  Grazing after hay . . . . ii. 284
  Improvement of. See Hill pasture i. 343
  Insufficient attention to . . ii. 280
Pastures—
  Management of . . . . ii. 280
  Manuring . . . . ii. 281, 287
  Mole-draining for . . . . i. 74
  Permanent, on poor clay soil . ii. 288
  Profit from . . . . . ii. 281
  Should not be mown . . . ii. 280
  Sowing grass with another crop . ii. 286
  Sowing grass seeds alone . . ii. 286
  Sowing permanent . . . ii. 286
  Stocking of . . . . . ii. 283
  Store cattle on . . . . . iii. 362
  Trials in England . ii. 49, 285, 286
  Value of . . . . . ii. 284
  Water-supply for . . . . ii. 284
  Weeds in . . . . . ii. 284
Pasturing sheep on arable farms . iii. 382
" " on hill-farms . iii. 383
" work-horses . . iii. 321
Pathology of the plant . . . i. 14
Pavement, specification for . i. 238, 242
Peas—
  And beans . . . ii. 146, 153, 398
  Beetle . . . . . ii. 445
  Consumption of . . . . ii. 148
  As food for stock . . . . iii. 273
  Harvesting . . . . . ii. 209
  Midge . . . . . ii. 460
  Mildew of . . . . . ii. 412
  Moth . . . . . ii. 460
  Produce of . . . . . ii. 148
  For sheep . . . . . iii. 274
  Sowing . . . . . ii. 153, 154
  Stacking . . . . . ii. 209
  Straw . . . . . ii. 148
  Summer culture of . . . ii. 154
  Thatching . . . . . ii. 209
  Thrips . . . . . ii. 461
  Tillage for . . . . . ii. 153
  Vegetable casein . . . . iii. 273
  Weevils . . . . . ii. 459
Peat drains . . . . . i. 58
Peat-moss as litter . . . . iii. 322
Peaty soils . . . . . i. 299
Peewit, the . . . . . ii. 440
"Peignon" wire fence . . . i. 121
Penal clauses in lease . . . i. 276
Penistone sheep . . . . . iii. 204
Percentage composition of ordinary foods iii. 290
Perennial red clover . . . ii. 74, 242
" rye-grass, seed of . . ii. 85, 237
Permanent fences . . . . i. 91
" pasture, formation of . . ii. 285
" grasses and clovers for . ii. 245
Peruvian guano . . . . . i. 486
Pests. See Crop pests . . . ii. 442
Pheasant, the . . . . . ii. 441
Philosophy, Natural . . . . i. 19
Phoma fungus in swedes . . . ii. 414
Phosphate, bone and mineral . . i. 502
" of lime, composition of . . i. 501
" " solubility of . . i. 501
Phosphates—
  Analyses of commercial . . i. 499
  Lime and soluble . . . . i. 362
  Precipitated . . . . . i. 501
  Soluble, or superphosphates . i. 501
  For turnips . . . . . ii. 343
Phosphatic layers . . . . i. 498
" manures . . . . . i. 493
" " choice of . . . i. 503
" " effect of . . . i. 328
" " experiments . . . ii. 34
Phosphoric acid in soils . . . i. 320
" " for turnips . . ii. 341

Phosphorite . . . . i. 498
" composition of . . . i. 498
Phycomycetes, the . . . . ii. 405
Physical condition of the soil . . i. 318
" geography of farms . . . i. 261
" properties of soils . i. 308
Physics . . . . . i. 19
Pick, hand- . . . . . i. 91
Pickling wheat . . . . . ii. 130
Piece-work by farm servants . i. 294
Piers, specification for . . i. 231
Pig dung . . . . . i. 466
Pigeons . . . . . ii. 434
Piggaries . . . . . i. 184
Construction of . . . . i. 184
Material for construction of . . i. 186
Specification for . . . . i. 185
Pigs—
Breeds of . . . . . iii. 8, 210
Carcase competitions . . . iii. 413
Castrating . . . . . iii. 221, 498
Diagrams of side of bacon . . iii. 416
Early maturity in . . . iii. 220
Farrowing . . . . . iii. 217
Feeding young . . . . iii. 221
Live- and dead-weight of . . iii. 410
Management of . . . . iii. 217
Meals, &c., for . . . . iii. 221
Nomenclature of . . . . iii. 224
Period of gestation . . iii. 217, 499
Rearing and feeding . . . iii. 220
Rest for feeding . . . . iii. 224
Seasons of farrowing . . . iii. 219
Trough . . . . . iii. 223
Weaning . . . . iii. 219, 221
Pillars, specification for . . . i. 238
Pipe *v.* porous drains . . . . i. 80
Pipe-laying, iron . . . . . i. 69
Pipes, areas of drain- . . . . i. 81
" for drains . . . i. 59, 60, 61, 62
" specification for drain- . i. 230, 240, 243
"Pirling" . . . . . ii. 186
Pit ponies . . . . . iii. 59
Pits, carrot . . . . . ii. 396
" field, for potatoes . . . ii. 321
" turnip, in the field . . . ii. 361
Plans—
For farm dwelling-houses . . i. 189
Of bothies . . . . . i. 227
Of family cottages . . . i. 207
Of farmhouses . . . . i. 189, 192
Of labourers' cottages . . . i. 206
Of piggeries . . . . . i. 184
Of steadings . . . . . i. 130
Plant food—
And fertility . . . . . i. 319
Distribution of, in soils . . i. 320
In dung . . . . . ii. 4
Insoluble phosphates as . . ii. 53
Lime dissipating . . . . i. 361
Removal and return of, by manuring . . . . . i. 449
Plant pathology . . . . . i. 14
Plantations—
Reclaiming ground . . . i. 337
Shelter from . . . . . i. 90
" wall and . . . . i. 89
Thorn hedges around . . . i. 95
Planting cabbages . . . . ii. 371
" kohl-rabi . . . . . ii. 393
" potatoes . . . . . ii. 303
" strawberries . . . . ii. 399
Planting and rearing hedges . . i. 91
" thorn hedges . . . . i. 91
" tools for . . . . . i. 91
Plants—
Ashes of the . . . . . i. 305
Assimilation of ammonia by . i. 491
Discriminating soils by . . i. 312
Distribution of, in soils . . i. 316
Frosts throwing out . . . ii. 118
Fungus diseases of . . . ii. 405
Growth and temperature . . i. 262
Inorganic matter in . . . i. 307
Leguminous . . . . . ii. 146
Lice, general treatment for . . ii. 444
Mutual dependence of animals and i. 14
Natural Orders of . . . i. 14
New varieties of farm . . ii. 116
Relation of, to soils . . . i. 315
Uprooted by frost . . . ii. 68
Utilisation of air nitrogen by . i. 332
What they draw from the soil . i. 306
Plashing hedges . . . . . i. 98
Plaster and lath work, specification for i. 240, 244
Ploughing . . . . . i. 368
A regular pace best . . . i. 388
Advantages of steam- . . . i. 422
Ancient form of ridges . . . i. 392
Anomalies in . . . . . i. 87
Bad . . . . . i. 397
For beans . . . . . ii. 150
Best ploughmen . . . . . i. 385
Casting ridges . . . . . i. 396
Characteristics of correct . . i. 386
Clay land not to be ploughed wet i. 398
Cross . . . . . i. 396
Cross-, land . . . . . ii. 144
Crown-and-furrow . . . . i. 395
Deep . . . . . i. 399
Different forms of ridges . . i. 391
Digging and . . . . . i. 368
" and grubbing . . . i. 399
Direction of ridges . . . i. 391
Effects of a crested furrow-slice . i. 382
" of a rectangular furrow-slice i. 382
Extent ploughed at different speeds i. 387
Feering . . . . . i. 392
Finish or mould furrows . . i. 395
Form and position of furrow-slice i. 385
Friction of the earth . . . i. 374
In frost and snow . . . . i. 398
Gathering up ridges . . . i. 394
Or grubbing for turnips . ii. 329, 330
Harness for . . . . . i. 379
" weight and cost of . i. 380
Headridges . . . . . i. 400
High-crested furrows objectionable i. 389
Injury by too deep . . . i. 421
Judges at, matches . . . i. 389
Lea in winter . . . . . ii. 66
Learning . . . . . i. 385
Long and short ridges . . . i. 387
Matches . . . . . i. 388
Medals of the H. & A. Society . i. 388
Modes of . . . . . i. 391
Movement of the furrow-slice i. 386
Number of furrows . . . i. 395
For oats . . . . . ii. 137
Open furrows . . . . i. 395
Parts of ridges . . . . i. 391
Prejudice against steam- . . i. 421
Rain-water channels . . . i. 398
Ridges and feerings . . . ii. 146
Shallow . . . . . i. 399
Smashing up the soil . . . i. 399
Speed of horses . . . . i. 387
In spring . . . . . ii. 60
Steam- . . . . . i. 421
Steep land . . . . . i. 388

Ploughing—
Stubble-land . . . . . i. 398
Subsoiling . . . . . i. 399
Trench and subsoil . . . . i. 400
Unseasonable . . . . . i. 400
Varying methods to suit soil . i. 391
Water-runs or gaws . . . . i. 400
Weight of deep and shallow furrows i. 385
For wheat . . . . . ii. 117
Wide and broken furrow . . i. 382
Width of ridges . . . . . i. 391
With three horses . . . . i. 381
" two horses . . . . . i. 380
Ploughman, duties of . . . . i. 7
" how employed in bad weather . i. 7
Ploughs . . . . . i. 368
Actions of various . . . . i. 381
Advantages of the double-furrow . ii. 120
American . . . . . i. 375
Body of, and length of wrest . i. 373
Chilled . . . . . i. 372
Chilled-steel . . . . . i. 382
Construction of common . . i. 368
And diggers . . . . . i. 383
Digging . . . . . ii. 320
Double-furrow . . . i. 372; ii. 120
Drainage . . . . . i. 63
Draught of . . . . . i. 375
Drill . . . . . i. 373
English wheel . . . . . i. 371
Iron hammer nut-key for . . i. 390
Irons . . . . . i. 384
Length of beam . . . . . i. 373
" of stilts and leverage . i. 373
Mechanics of . . . . . i. 373
Modern Scottish . . . . . i. 370
Mole-draining . . . . . i. 75
Paring . . . . . i. 351
Quantity of earth turned over by i. 389
Reins . . . . . i. 380
Scottish drill- . . . . . ii. 302
Scottish swing- . . . . . i. 369
Slide . . . . . i. 390
Small's . . . . . i. 381
Staff . . . . . i. 375
Steam- . . . . . i. 423
Subsoil . . . . . i. 401
Swing-trees . . . . . i. 375
Tempering . . . . . i. 383
Triple drill- . . . . . ii. 306
Turn-wrest or one-way . . i. 372
Varieties of . . . . . i. 369
Weight of . . . . . i. 375
Wheels on . . . . . i. 374
Wilkie's . . . . . i. 382
Yoking horses in . . . . i. 374, 376
Plovers . . . . . ii. 440
Plug drains . . . . . i. 57
Plumber-work, specifications for ii. 240, 243
Plunge-churns . . . . . ii. 496
Peas, seeds of . . . . . ii. 87
Poison, beans containing . . . ii. 147
Polecat, the . . . . . ii. 425
Polled breeds of cattle . . . iii. 62
Polo pony . . . . . iii. 43
Ponies—
Atholl . . . . . iii. 50
Celtic . . . . . iii. 54
Connemara . . . . . iii. 46
Dartmoor . . . . . iii. 44
English and Irish . . . . iii. 41
Exmoor . . . . . iii. 44
Experiments with Highland . iii. 54
Fell . . . . . iii. 45
Fell and Arab crosses . . . iii. 52
Ponies—
Galloway . . . . . iii. 48
Hackney and harness . . . iii. 42
Highland . . . . . iii. 48
Inverness-shire . . . . . iii. 51
Island . . . . . iii. 53
Management of . . . . . iii. 47
Mull . . . . . iii. 53
New Forest . . . . . iii. 44
Polo . . . . . iii. 43
Ross-shire . . . . . iii. 51
Rum . . . . . iii. 53
Shetland . . . . . iii. 54
Skye . . . . . iii. 53
Types of . . . . . iii. 41, 42
Uist . . . . . iii. 53
Welsh . . . . . iii. 45
Wintering hill . . . . . iii. 47
Pont l'Evêque cheese . . . . ii. 521
Poor land, improving . . . . i. 340
Poppy-cake as food . . . . iii. 278
Porcelain milk dish . . . . ii. 488
Porous drains . . . . . i. 79
" *v.* pipe-drains . . . . i. 80
Portable engines . . . . . i. 415
" threshing-machine . . . ii. 213
" weighing-machine . . . ii. 230
Posts, specification for main . . i. 232
" and fencing, specification for . i. 235
Pot-culture experiments . . . ii. 50
Potash—
And soda in soils . . . . i. 305
As a manure . . . . . i. 329
In soils . . . . . i. 320
Manures, experiments . . . ii. 37
Nitrate of . . . . . i. 489
For potatoes . . . . . ii. 298
Solubility of, in soils . . . i. 322
Sources of . . . . . i. 504
For turnips . . . . . ii. 341, 343
Use of . . . . . i. 504
Potatoes . . . . . ii. 295
Adjusting force of labour . . ii. 320
Dr Aitken on manuring . . ii. 298
Analysis of . . . . . ii. 394
Application of manure for . . ii. 301
Arranging the gatherers . . ii. 317
Assorting . . . . . ii. 317
Autumn dunging . . . . . ii. 301
" planting unsuitable . ii. 308
Ayrshire practice in planting . ii. 306
Barrels for early . . . . . ii. 315
Blossom, vertical section . . ii. 312
Boxing system of preparing sets . ii. 308
Carting dung for . . . . . ii. 302
For cattle . . . . . iii. 369
College trials in manuring . . ii. 301
Colorado beetle . . . . . ii. 461
Complete planting as it proceeds . ii. 306
Conveying seed to the planters . ii. 305
Covered-court manure for . . i. 166
Covering in . . . . . ii. 306
Cross-fertilisation . . . . ii. 311
Culture after . . . . . ii. 307
Death's-head moth . . . . ii. 462
Depth of sets and distance apart . ii. 307
Difficult to preserve . . . ii. 321
Digger . . . . . ii. 317
Digging by drill-ploughs . . ii. 320
Disease . . . . ii. 296, 316, 406
" resisting varieties . . ii. 310
Diseased tubers . . . . . ii. 318
Distributing dung from carts . ii. 303
Distribution of the . . . . ii. 296
Drill roller . . . . . ii. 307

Potatoes—
The drill system . . . . ii. 304
Dung and seed not to be left uncovered . . . . . ii. 306
Dung for . . . . . ii. 297
Early blight or leaf curl . . ii. 417
Experiments in spraying . . ii. 49
Experiments with late planting . ii. 307
Filling dung . . . . . ii. 302
As food . . . . . iii. 282
Forking after ploughs . . . ii. 321
Frosted . . . . . ii. 323
Gatherers required . . . . ii. 317
General observations on manuring ii. 301
Sir Henry Gilbert on dung for . ii. 300
Good potatoes . . . . . ii. 296
Graip . . . . . ii. 315
Hand-basket . . . . . ii. 306
" hoeing . . . . . ii. 307
Harrowing . . . . . ii. 320, 321
Heating . . . . . ii. 323
For horses . . . . . iii. 283
Improved digger best . . . ii. 321
Ingredients in manure . . . ii. 298
Introduction into Europe . . ii. 295
Land suitable for planting . . ii. 296
Lazy-bed system . . . . . ii. 310
Lifting and selecting . . . ii. 314
Male and female organs . . ii. 311
Manuring . . . . . ii. 297
Marking fertilised plum . . ii. 313
Medium-sized . . . . . ii. 316
Methods of raising . . . ii. 315
Need for new varieties . . . ii. 315
Nitrogen for . . . . . ii. 298
Period of development . . . ii. 314
Pits . . . . . ii. 321
Planting . . . . . ii. 303
In autumn . . . . . ii. 308
On the flat . . . . . ii. 304
Machines . . . . . ii. 305
The seed . . . . . ii. 305
Boxed seed . . . . . ii. 309
Ploughs . . . . . ii. 320
Plum . . . . . ii. 313
Potash for . . . . . ii. 298
Preserving sets . . . . . ii. 304
Process of cross-fertilisation . ii. 312
" digging . . . ii. 318
Quantity of seed per acre . . ii. 304
Raiser attached to plough . . ii. 321
Raising . . . . . ii. 315
Early varieties . . . ii. 315
By the graip . . . . ii. 315
Late or main crop . . . ii. 316
New varieties of . . . ii. 310
Ripe plums . . . . . ii. 313
Rothamsted experiments with . ii. 299
Scab . . . . . ii. 417
Section of a flower . . . ii. 311
Securing and storing seeds . . ii. 313
Seed . . . . . ii. 303, 311
" for autumn planting . . ii. 308
" magnified . . . . ii. 313
" pits . . . . . ii. 323
Seedless varieties . . . . ii. 311
Shaws as thatch . . . . ii. 323
Single *v.* drill plough . . . ii. 304
Small . . . . . ii. 316
Soil and tillage for . . . ii. 296
Sowing artificial manure . . ii. 303
" the seed . . . . ii. 313
Speedy marketing . . . ii. 316
Spreading dung . . . . ii. 303
Spring dunging . . . . ii. 302

Potatoes—
Spring tillage with autumn dung ii. 302
Storing . . . . . ii. 321
" seedling . . . . ii. 314
" wet . . . . . ii. 323
Tillage for . . . . . ii. 296
Tubers boxed . . . . . ii. 308
" free from earth . . ii. 318
Utilising diseased . . . iii. 282
Varieties of . . . . . ii. 295
Ventilating pits . . . . ii. 323
Warty disease of . . . . ii. 410
Weather and digging . . . ii. 320
Wheat after . . . . . ii. 119
Width of drills . . . . ii. 307
Winter rot of . . . . . ii. 412
Yield of . . . . . i. 326; ii. 229
Yorkshire method of storing . ii. 322
Young seedling . . . . ii. 313
Poultry . . . . . iii. 236
Advantages of pure breeds . . iii. 240
Classification of breeds . . iii. 237
Co-operation marketing . . iii. 252
Cross-bred . . . . . iii. 239
Diseases of . . . . . iii. 253
Ducks . . . . . iii. 240
Early moulting . . . . iii. 251
Fancy breeds . . . . . iii. 239
Feather-eating or depluming scabies iii. 431
Feeding . . . . iii. 247, 248
Fixed houses . . . iii. 246
Geese . . . . . iii. 245
General purpose breeds . . iii. 238
Hatching eggs, time of . iii. 236
Housing . . . . . iii. 245
Incubation . . . . . iii. 249
Laying competitions . . iii. 251
" varieties . . . . iii. 237
Marketing . . . . iii. 251, 252
New-laid eggs . . . iii. 236
Preserving eggs . . . iii. 252
Rearing . . . . . iii. 236
Scaly leg of . . . . iii. 431
Table breeds . . . . iii. 238
Testing eggs . . . . iii. 250
Tuberculosis of . . . . iii. 255
Turkeys . . . . . iii. 245
Vices in . . . . . iii. 256
Winter eggs . . . . . iii. 251
Power for the dairy . . . ii. 477
" motive, for threshing-machines . ii. 216
Practical farming—
Acquiring a knowledge of . i. 1
Different systems of . . i. 4
Difficulties in learning . . i. 2
Foresight essential in . i. 2
Practice, science with . . . i. 10
Pregnancy—
Critical period of . . iii. 331
Feeding in-calf cows . . . iii. 331
Gestation . . . . iii. 331
Prolapse of the vagina . . iii. 331
Reckoning time of calving . iii. 331
Symptoms of . . . . iii. 330
Preserving cream . . . ii. 492
" milk . . . . ii. 481
Presses, cheese . . . . ii. 503
Pressing hay . . . . . ii. 279
Prey, birds of . . . . ii. 431
Prickly comfrey . . . . ii. 376
" " as a forage crop . iii. 289
Prime movers . . . . i. 21
Principles of bee-keeping . . iii. 258
" of stock-breeding . iii. 224
Prismatic boss for ventilating stacks ii. 201

Prismatic pit for storing potatoes ii. 322
Procrastination, evils of ii. 61
Produce—
Conditions as to disposal of i. 274
Drainage increasing i. 50
Rent i. 268
Rotation and outlet for i. 437
Profit and loss account i. 252
Protection to timid animals i. 154
Protozoa, classification of i. 16
Pruning hedges i. 95
Public health regulations for steadings i. 130
Pulped food for store cattle iii. 361
Pulping roots for cattle iii. 355
Pulveriaing ploughs ii. 330
Pump, liquid-manure i. 160, 481
Pumpherston, experiments with manures at ii. 33
Pupils—
Farm i. 1, 2, 3
Fees for farm i. 2
Training of farm i. 3
Purchasing of manures i. 505
Pure-culture for butter-making ii. 493
Purifying and preserving milk ii. 481

Quicks, planting young i. 100

Rabbits, hares and ii. 429
Rabbit-warren wire fence i. 116
Racks—
Cheese ii. 502
For drying grain ii. 202, 208
For sheep iii. 394
For straw i. 152
Hay, for horses i. 172
Metal mangers and i. 172
Radiation, preventing loss of heat by i. 406
Radnor sheep iii. 182
Railway milk-churn or can ii. 486
Rain i. 27
Ammonia in i. 29
In autumn ii. 65
Snow-water and ii. 69
In spring ii. 59
In summer ii. 62
Theory of i. 28
In winter ii. 68
Rainfall—
Amount of i. 28
And artificial manures i. 518
And crops i. 264
And loss of liquid manure i. 480
And sheep farming i. 264
Distribution of i. 28
In Great Britain i. 29
Influence of ii. 11
And time of sowing manure ii. 10
Weight of, per acre i. 29
Rain-gauge i. 27
" position of i. 27
Rainless districts i. 28
Rain-water—
Carbonic acid and oxygen in i. 49
Channels i. 398
Evaporation of i. 47
Fertility from i. 48
Loss of manurial elements in ii. 16
Nitrogen and sulphuric acid from i. 48
Salt from i. 48
Spouts i. 160
Raising cream ii. 486
" potatoes ii. 315
Rake, hay hand- ii. 272
Raking grain ii. 185
Raking hay ii. 264
Rakings, drying ii. 185
Ram, hydraulic i. 153
Ransomes' horse-rake ii. 260
" ploughs i. 371, 372
" threshing-machine ii. 215
Rape ii. 374
" for sheep iii. 396
Rape-cake as food iii. 278
" as food for cattle iii. 276
" impurity of Indian iii. 276
Rape-dust i. 488
Rapes, seed of ii. 73
Raspberries ii. 400
Beetle ii. 467
Moth ii. 467
Weevil ii. 467
Ratio of different ingredients in manures i. 519
Rations for dairy cows iii. 344
" feeding, for fattening cattle iii. 365
" for horses iii. 317, 319, 320
Rats ii. 426
Raven, the ii. 432
Raynbird, Mr, on cross-fertilisation of grain ii. 105
Reaper and mower, Jack's ii. 257
Reaper-binder. See Binder ii. 176
Reaping. See Grain harvest ii. 167
Reaping appliances—
Binder ii. 177
Harvesting by motor ii. 182
Reaping-machine ii. 172
Scythe ii. 170
Sickle or "hook" ii. 169
The stripper harvester ii. 182
Reaping-machines—
American ii. 174
Ancient ii. 172
Bell's ii. 172
Dray's Hussey ii. 174
First effective ii. 172
Harrison M'Gregor's ii. 176
Historical ii. 172
Howard's ii. 176
Knife-sharpener ii. 183
M'Cormick's ii. 174
Manual and self-delivery ii. 176
Modern ii. 174
Nineteenth-century machines ii. 172
Price of ii. 175
Speed of ii. 175
Varieties of ii. 175
Rearing of calves iii. 348
" foals iii. 327
" and planting hedges i. 91
Réaumur scale i. 25
Recipes for ailments of farm live stock iii. 493
Reclamation of waste land i. 335
Record of holding i. 277
Records, milk ii. 480
Recreation, winter ii. 67
Red-clover seed ii. 401
Red Polled cattle iii. 78
Combination of beef and milk iii. 81
Improved Red Poll iii. 78
Management of iii. 80
Milk yields iii. 80
Modern types iii. 79
Standard description iii. 79
Weights iii. 80
Red-shank, seed of ii. 78
"Redonda" and "Alta Vela" phosphates i. 499
Re-draining land i. 74
Reed-hunting, the ii. 438

Refrigerating machines . . . ii. 484
Reins, bearing- . . . . . i. 379
" plough- . . . . . i. 380
Removal, conditions as to . . . i. 276
Rennet . . . . . ii. 503
Rent—
Advantages of a fixed money- . i. 269
And land value . . . . i. 269
Conditions regulating . . . i. 261
"Covenanted" . . . . i. 269
Day in lease . . . . . i. 272
Estimating . . . . . i. 267
Fixed money . . . . . i. 269
Interest, profit, and . . . i. 269
Landowners "asking" . . . i. 271
Methods of estimating . . i. 267
Mixed . . . . . i. 268
Offering . . . . . i. 270
Renting and entering farms . . i. 261
Reopening drains . . . . i. 71
Repairs essential . . . . . i. 270
" and renewals . . . . i. 279
Research, Government grants for . i. 39
" specialism in scientific . i. 11
Research work in Aberdeenshire . ii. 51
" by Highland and Agricultural Society . . . . . ii. 33
" at Rothamsted . . . . ii. 1
" by Royal Agricultural Society . ii. 42
Residual soils . . . . . i. 301
Retting flax . . . . . ii. 389, 392
Rhubarb . . . . . ii. 399
Rib-grass, seed of . . . . ii. 77
Rice as food for stock . . . . iii. 273
Rice-meal as food for stock . . iii. 273
Richmond grain-drying rack . ii. 202
" potato-planter . . . ii. 305
Rick-cloth for hay-stacks . . ii. 277
Rick-stands . . . . . i. 176
"Rickling," advantages of . . ii. 189
" temporary stacking or . ii. 189
Riddles . . . . . ii. 225
Ridges—
Ancient form of . . . . i. 392
Casting . . . . . i. 396
Different forms of . . . i. 391
Direction of . . . . . i. 391
Feerings for ploughing . . i. 397
Gathering up . . . . i. 394
Ill-ploughed . . . . . i. 397
Mode of feering . . . . i. 393
Parts of . . . . . i. 391
Ploughing, and feerings . . ii. 146
Width of . . . . . i. 391
"Rig" (or "chaser") lamb . . iii. 380
Ring-dove, the . . . . . ii. 434
Ring-fences . . . . . i. 86
Ripening cream . . . . . ii. 493
" grain . . . . . ii. 168
Rippling flax . . . . . ii. 388
"Roads," cutting . . . . ii. 183
Road-scrapings, Cambridge . . i. 497
Roads . . . . . i. 122
Ancient . . . . . i. 122
Arrangement of farm . . . i. 122
Benefits of good . . . . i. 122
Binding material for . . . i. 125
Cost of maintenance . . . i. 125
Cross section of . . . . i. 124
Drainage of . . . . . i. 124
Grades and gradients . . . i. 123
Laying out . . . . . i. 123
Repairing . . . . . i. 125
Side channels . . . . . i. 124
Size of metal for . . . . i. 124
Roads—
Stones for road-metal . . . i. 124
To farm buildings . . . i. 128
Width of . . . . . i. 123
Rock guano . . . . . i. 499
Rocks, specific gravity of . . i. 24
Rodents . . . . . ii. 426
Rollers—
Diameter and weight of . . ii. 142
Divided . . . . . ii. 142
Drill . . . . . ii. 307
Water-ballast . . . . ii. 143
Rolling for grass seeds . . . ii. 249
" wheat . . . . . ii. 118
Rolling land . . . . . ii. 141
Process of . . . . . ii. 143
Speed in . . . . . ii. 143
Time for . . . . . ii. 143
Romney Marsh sheep, Kent or . . iii. 156
Rones, specification for . . i. 240, 243
Roof boarding, specification for . . i. 234
" for court . . . . . i. 164
" spans, specification for i. 232, 233
Roofing cattle-courts . . . i. 163
" specification for . i. 238, 242
Roofs, specification for felt on . i. 235
" of steadings . . . i. 181
Rook, the . . . . . ii. 432
Root- or bulb-eating slug . . ii. 474
Root-alcohol for industrial purposes ii. 403
Root cultivation, drainage and . . i. 50
Roots. See Turnips, Mangels, &c.
Carting . . . . . ii. 366
Different kinds of, for store cattle iii. 360
Frozen, bad for cattle . . . iii. 355
For horses . . . . . iii. 319
Sowing in summer . . . ii. 63
Storing . . . . . ii. 366
Quality of barley after . . ii. 134
Range of . . . . . i. 434
Rothamsted experiments . . ii. 28
Variation in nutritive value of . iii. 279
Washing, for cattle . . . iii. 355
Ropes, care of . . . . . ii. 191
" cart- . . . . . ii. 191
" straw for . . . . . ii. 196
Roping hay-stacks . . . . ii. 272
" a loaded cart . . . . ii. 192
" lozenge . . . . . ii. 198
" stacks . . . . . ii. 198
Roquefort cheese . . . . . ii. 519
Roscommon sheep . . . . iii. 157
Rose, mildew of . . . . . ii. 412
Ross-shire ponies . . . . iii. 51
Rotation of crops . . . . . i. 433
And climate . . . . . i. 437
And labour . . . . . i. 437
Arable *v.* pasture . . . . i. 437
Conditions as to leaving farm . i. 275
For flax . . . . . ii. 385
General rules . . . . i. 440
Grass and . . . . . i. 437
Hay . . . . . ii. 261
" cutting . . . . . ii. 255
" manuring . . . . ii. 251
Manures for differeot . . . i. 518
Sample rotations . . . . i. 438
Seeds for, grasses . . . . ii. 244
Experiments at Woburn . . ii. 46
Rothamsted experiments . . . ii. 1-32
Barley . . . . . ii. 133
Continuous growth of . . . ii. 19
Produce of grain and straw averages ii. 20
Produce of hay per acre—1856-1902 . . . . . ii. 23

Rothamsted experiments—
Grass for hay . . . . . ii. 23
Changes in herbage by . . . ii. 27
Complete manures . . . ii. 26
Effect of lime . . . . . ii. 27
Effect of manures upon herbage . ii. 24
Mineral manures alone . . ii. 26
Nitrogenous manures alone . . ii. 24
Percentages of herbage—1856-1902 ii. 25
Malt . . . . . iii. 270
Other experiments . . . . ii. 32
Potatoes . . . . . ii. 209
Root crops . . . . . ii. 28
Average produce of roots . . ii. 28
Continuous growth of mangels . ii. 28
Effect of manures on tilth . . ii. 31
Farmyard manure for mangels . ii. 29
Manure recovered in crop . . ii. 31
Manures and incidence of disease ii. 32
Nitrogenous manures for mangels ii. 30
Potash salts for mangels . . ii. 30
Produce of roots and leaves . . ii. 29
Quantities of manures per acre . ii. 28
Trials on turnips . . . . . ii. 342
The soil . . . . . ii. 2
Soil and drainage-water investigations ii. 3
Wheat—
Ammonia with individual ash constituents . . . . . ii. 9
Ammonium-salts alone . . ii. 8
Ammonium-salts with ash constituents . . . . . ii. 6
Autumn and spring sowing of ammonium-salts . . . ii. 10
Behaviour of lime in soil . . ii. 18
Continuous growth of . . . . ii. 3
Effect of annual residue from ammonium-salts—average 1852-1906 ii. 14
Effect of annual residue of ash constituents—average 1852-1906 . ii. 14
Effect of autumn and spring applications of ammonium-salts . ii. 9
Effect of autumn weather due to fallowing . . . . . ii. 15
Effects of residues of manures . ii. 13
The fate of mineral constituents . ii. 17
Influence of season . . . ii. 12
Produce of wheat with ammonium-salts—average 1852-64 ii. 8
Produce of wheat with dung . ii. 4
Produce of wheat with nitrate of soda and ammonium-salts . ii. 4
Produce of wheat variously manured ii. 9
Produce of wheat variously manured—average for fifty-five years ii. 6
Produce of wheat without manure ii. 4
Proportion of corn to straw . . ii. 12
Tracing the fate of manures . . ii. 14
With ash constituents . . . ii. 5
With farmyard manure . . ii. 4
With nitrate of soda . . . . ii. 10
Without manure . . . . . ii. 3
The yield of dressed grain, &c. . ii. 12
Rove beetles . . . . . ii. 469
Royal Agricultural Society—
Aid to agricultural education by . i. 36
Experiments with wheat and barley ii. 43, 44
" ensilage . . ii. 50
" clover . . ii. 49
" lucerne . . ii. 49
" mangels . . ii. 49
" potatoes . . ii. 49
Feeding experiments . . . ii. 50
"Finger-and-toe" in turnips . ii. 49
Green-manuring experiments . ii. 47
Royal Agricultural Society—
Hellriegel's discoveries . . . ii. 47
Objects of the Woburn experiments . . . . . ii. 42
Other experiments with corn crops ii. 48
Pasture experiments . . . ii. 49
Pot-culture station . . . ii. 42, 50
Rotation experiments . . ii. 46
Trials of windmills in England i. 432
Woburn station . . . . ii. 42
Rum ponies . . . . . iii. 53
Runch, seed of . . . . . ii. 73
Rust, white . . . . . ii. 411
Rye . . . . . ii. 370
" bere and, as food for stock . . iii. 271
" carrots and . . . . ii. 395
" limits of culture of . . ii. 101
" sowing . . . . . ii. 141
" straw . . . . . ii. 103
" yield and weight of . . ii. 101
Rye-flour . . . . . ii. 102
Rye-grass, cabbages and Italian . . ii. 372
" flail for threshing . . ii. 278
" Italian . . . . ii. 376
" seed of . . . . ii. 84, 278
Ryeland sheep . . . . . iii. 178

Sack-barrow . . . . . ii. 229, 230
" lifter . . . . . ii. 229
Sacks—
Corn- . . . . . ii. 229
Loading a cart with . . . ii. 229
Mode of lifting . . . . ii. 228
Placing, in the field . . . ii. 120
Seed- . . . . . ii. 121
Tying, of corn . . . . ii. 228
Sainfoin . . . . . ii. 370
" cutting . . . . . ii. 255
" as food . . . . . iii. 289
" hay . . . . . ii. 370
Salt for sheep . . . . iii. 383, 396
" and chalk for calves . . iii. 375
" from rain-water . . . . i. 48
Salting butter . . . . . ii. 500
" and spicing hay . . . . ii. 277
Sandringham dairy-herd recorder . ii. 480
Sand-drains . . . . . i. 80
Sandy soil . . . . . i. 298
Sanitary engineering . . . . i. 22
Savoys . . . . . ii. 397
Scab mites . . . . . iii. 429
" sheep . . . . . iii. 432
Scaffolding, specification for . i. 241
Scaly leg of the fowl . . . . iii. 431
Scarifier, drill- . . . . . ii. 352
Science—
First degree in agricultural, in Britain . . . . . i. 31
Growing in favour . . . i. 10
Veterinary . . . . . i. 17
With practice . . . . i. 10
Sciences—
Applicable to agriculture . i. 9, 10
Prominence given to chemistry i. 10
To be studied by farmers . i. 11
Scientific character of Rothamsted trials ii. 3
" education widening . . i. 11
" research, specialism in . i. 11
Scoop, corn- . . . . . ii. 227
" liquid-manure . . . . i. 484
Scorpion-grass, seed of . . . ii. 82
Scotch hands for butter-making . ii. 501
Scotland, cattle-feeding in . . . iii. 366
Screens, corn- . . . . . ii. 225
Scutching flax . . . . . ii. 390

Scythe . . . . . ii. 170
Cutting "roads" with . . . ii. 183
Unsuitable for reaping wheat . ii. 188
Seal for binding cattle . . . i. 57
Seasons, the . . . . . ii. 57
Ash constituents and . . . ii. 13
Calendar and agricultural . . ii. 62
Effect of, upon barley . . . ii. 21
Influence of, on oats . . . ii. 139
" on crops . . . ii. 12
Seed—
Adulteration and deterioration . ii. 71
Of buttercups . . . . ii. 77
Change of . . . . . ii. 115
Of the chickweed family . . ii. 73
Classification of farm . . . ii. 72
Of the cleavers family . . . ii. 81
Clover . . . . . ii. 74, 241
Colour and gloss . . . . ii. 71
Of composites . . . . ii. 79
Of the cruciferous plants . . ii. 73
De Laune's mixtures . . . ii. 246
Depth for grass . . . . ii. 247
Of the dock family . . . ii. 78
Drill, hand . . . . . ii. 124
" turnip . . . . ii. 337
Examination of . . . . ii. 70
Form and surface of . . . ii. 70
Frost injuring clover . . . ii. 250
Germination of . . . . ii. 154
Grass . . . . . ii. 82
Hay for . . . . . ii. 253
Identification of . . . . ii. 70
Improvement in . . . . ii. 115
Impurities in farm . . . ii. 71, 75
Leguminous . . . . . ii. 74
Mericarps . . . . . ii. 80
Multiple fruits . . . . ii. 82
Nature of farm . . . . ii. 70
New or old . . . . . ii. 117
New varieties of farm plants . ii. 116
Of parasites . . . . . ii. 89
Parasites in . . . . . ii. 72
Quantity of seed per acre . . ii. 161
" for barley . . . ii. 132
" for oats . . . ii. 137
" for wheat . . . ii. 118
Two-faced rib-grass . . . ii. 77
For permanent pastures . ii. 245, 285
Red-clover . . . . . ii. 401
For rotation grasses . . . ii. 244
Sacks for . . . . . ii. 121
Size of . . . . . ii. 70
Sowing grass . . . . . ii. 247
Standard mixtures of . . . ii. 246
Testing . . . . . ii. 116
Time . . . . . ii. 115
" seasonable working of land . ii. 115
" selecting seeds . . . ii. 115
True . . . . . ii. 72, 73
Umbelliferous . . . . ii. 80
Wheat for . . . . . ii. 94
Seed-basket . . . . . ii. 121
" carrier . . . . . ii. 121
Seedling . . . . . ii. 156
Seedlings, the "damping off" of . ii. 405
Self-binder. See Binder . . . ii. 177
Self-delivery machines . . . ii. 176
Self-heal, seed of . . . . ii. 81
Sellar's ploughs . . . . . i. 370
Semi-portable steam-engine . . i. 416
Separated milk for calves . . iii. 352
Separators, cream . . . . ii. 492
Servants, duties of . . . . i. 294
" wages of farm . . . . i. 289
Setoning . . . . . iii. 498
" calves . . . . . iii. 354
Sewage irrigation . . . . . i. 357
"Shaking," shedding or, of grain . ii. 168
Shallow-pan system of cream-raising . ii. 487
Sheaf-binding harvester. See Binder . ii. 177
" gauge . . . . . ii. 170
" ripening of grain in the . ii. 167
Shearing sheep . . . . . iii. 384
Sheare, wool- . . . . . iii. 385
Sheaves, lifting broken stalks . ii. 185
" size of . . . . . ii. 185
" small . . . . . ii. 187
" for wheat . . . . . ii. 188
Shedding or shaking of grain . ii. 168
Sheep—
"Acclimatisation" value of . i. 279
And arable farming, barns for . i. 134
Abortion, microbe of . . . iii. 337
Administrating medicine to . iii. 496
Ailments of . . . . . iii. 484
Arable land on, farms . . . iii. 400
Prof. Axe on abortion among . iii. 381
Barb-wire fences for . . . i. 113
Bathing or "pouring" . . . iii. 387
Begin cautiously with turnips . iii. 393
Begin turnip-feeding early . iii. 393
Bridging rivulets for . . . iii. 403
British wool . . . . . iii. 404
Blackface, in winter . . . iii. 396
Cabbages for . . . . . iii. 282
Cake-breaker . . . . . iii. 396
Carcase competitions . . . iii. 412
Carting turnips on lea land in bad weather . . . . . iii. 392
Comparative value of foods for . iii. 300
Cost of turnip-feeding for . iii. 398
Cots or sheds . . . . . iii. 401
Cutting turnips for . . . iii. 395
Diagram showing cutting of carcase iii. 415
Dipping of. See "Dipping" . iii. 387
Disposal of fat, in summer . . ii. 63
Dogs . . . . . iii. 264
Draft ewes on turnips . . . iii. 393
Dressing for foot-rot . . . iii. 170
Dry food with turnips for . . iii. 393
Dung . . . . . i. 466
Enclosing, on turnips . . . iii. 391
Excessive valuations for . . i. 279
Experiments with foods for, on roots . . . . . iii. 397
Extent of roots given at a time . iii. 392
Ewes and lambs, treatment of . iii. 382
Feeding-box for . . . . iii. 169
Feeding experiments with . . iii. 294
Feeding shed . . . . . iii. 399
Feeding in sheds . . . . iii. 398
Fertility in . . . . . iii. 390
Fodder-racks . . . . . iii. 394
Force at clipping . . . . iii. 385
Heather burning . . . . iii. 383
"Home-wintering" or "sending away" . . . . . iii. 399
House-feeding of . . . . iii. 398
Irrigation on hill-farms . . iii. 400
Is claying lands injurious to? . i. 348
Ked or louse-fly . . . . iii. 424
Lime and sulphur dip . . . iii. 433
Live-weight increase and its cost . iii. 397
Long-wooled breeds of . . . iii. 138
Maggot-fly . . . . . iii. 383, 423
Marking . . . . . iii. 386
Methods of clipping . . . iii. 385
Nets . . . . . iii. 391
Nomenclature of . . . . iii. 403

Sheep—
Noatril-fly . . . . . iii. 421
Oats and hay for hoggs . . iii. 396
Paddocks for . . . . . iii. 401
Pastoral farming . . . . . i. 132
Pasturing on arable farms . iii. 383
" on hill-farms . . iii. 383
Peas for . . . . . iii. 274
Period of gestation . . iii. 236, 499
Picking out turnip-shells . . iii. 394
Preparing turnips for . . . iii. 391
Rape for . . . . . iii. 396
Recipes for ailments of . . iii. 495
Registering marks . . . iii. 387
Ross-shire example of house-feeding . . . . . iii. 398
Salt for . . . . . iii. 383, 396
Saving hay for hill-farms . . iii. 400
Scab, common . . . . iii. 432
" dressing for . . . iii. 390
Shearer, hand-power . . . iii. 385
Shearing machines . . . iii. 385
Shearing of . . . . . iii. 384
Shelter for, on turnips . . iii. 397
Shepherding hill . . . . iii. 380
Shifting on pasturea . . . iii. 382
Short-wool and Down breeds of . iii. 162
Smearing . . . . . iii. 387
Stells for . . . . . iii. 401
Stocks, valuing . . . . i. 279
Store, in summer . . . . iii. 382
Storing turnips for ewes . . ii. 362
Storing wool . . . . iii. 385
Substitutes for feeding-racks . iii. 394
Summer fattening . . . iii. 382
Supplementing dykes for . . i. 109
System of ear-marking . . iii. 166
Ticks in . . . . . iii. 433
Time of shearing . . . . iii. 384
Tupping season . . . . iii. 390
Turnip-cutter cart . . . iii. 395
Turnip-tops as food for . . ii. 358
Turnip-tops for . . . . iii. 393
Turnips consumed on ground by . ii. 357
On turnips in winter . . ii. 67
On turnips during snow . . iii. 396
On turnips in winter . . iii. 391
Turnips risky for ewes . . iii. 393
Unclipped sheep falling . . iii. 383
Unripe turnips dangerous . . iii. 396
Washing of . . . . . iii. 384
Water for . . . . . iii. 382
Wheat for . . . . . iii. 269
In winter . . . . . iii. 390
Wintering, on pastoral farms . iii. 399
Wintering, in Romney Marsh . iii. 400
Wire nets . . . . . iii. 392
In a wood in a snowstorm . . iii. 396
Wool-shears . . . . . iii. 385
Young, on turnips . . . iii. 393
Young, best for hill-farms . . iii. 403
Sheep, breeds of . . . . . iii. 7
Sheep, varieties of—
Blackface . . . . . iii. 183
Border Leicester . . . . iii. 140
Cheviot . . . . . iii. 189
The Clun sheep . . . . iii. 203
Cotswold . . . . . iii. 150
Dartmoor . . . . . iii. 195
Derbyshire Gritstone . . . iii. 201
Devon long-wool . . . . iii. 152
Dorset Down . . . . iii. 178
Dorset or Somerset horn . . iii. 180
Exmoor horn . . . . iii. 194
Foreign breeds . . . . iii. 205
Sheep, varieties of—
Half-bred . . . . . iii. 158
Hampshire down . . . . iii. 170
Herdwick . . . . . iii. 197
Kent or Romney Marsh . . iii. 156
Kerryhill (Wales) . . . iii. 200
Leicester . . . . . iii. 138
Lincoln, long-wool . . . iii. 148
The Lonk . . . . . iii. 196
Masham . . . . . iii. 204
Merino . . . . . iii. 205
The Norfolk . . . . . iii. 203
Other types . . . . . iii. 205
Oxford Down . . . . iii. 173
Penistone . . . . . iii. 204
Radnor . . . . . iii. 182
Roscommon . . . . . iii. 157
Ryeland . . . . . iii. 178
Shetland . . . . . iii. 204
Shropshire . . . . . iii. 164
South Devon . . . . . iii. 153
Southdown . . . . . iii. 162
Suffolk . . . . . iii. 176
Welsh . . . . . iii. 198
Wensleydale . . . . iii. 154
Wiltshire . . . . . iii. 204
Sheep-drawing pen . . . . iii. 167
Sheep-farming and rainfall . . i. 264
Sheep's fescue, seed of . . . ii. 86
" sorrel, seed of . . . ii. 78
Sheet-iron fence . . . . i. 115
Shelter—
Fencing for . . . . . i. 89
From dykes . . . . . i. 110
From fences . . . . . i. 87
From plantations . . . i. 90
From stake-and-rice fence . i. 102
From wall and plantation . i. 89
On sheep-farms . . . iii. 401
For sheep on turnips . . iii. 397
On upland farms . . . i. 90
Overdone in enclosing fields for . i. 89
"Sheltie," or pony . . . iii. 58
Shelves of dairy . . . . ii. 489
" milk . . . . . ii. 476
Shelving, specification for . . i. 243
Shepherd, qualifications of a . iii. 185
Shepherds, duties of . . . i. 8
Shepherd's hut . . . . iii. 377
" knot . . . . iii. 392
Sherardia, seed of . . . ii. 81
Shetland cattle, Orkney and . iii. 136
Shetland ponies . . . . iii. 54
Bressay Stud . . . . iii. 56
Distribution . . . . iii. 57
Management of . . . . iii. 58
In the mines . . . . iii. 56
Modern type . . . . iii. 56
Points of the breed . . iii. 57
Purity of . . . . . iii. 54
Shetland sheep . . . . iii. 204
Shire horse, the . . . . iii. 9
Characteristics . . . iii. 11
Dimensions and weight . iii. 11
Feeding and management . iii. 14
Ground for breeding . . iii. 9
Mating . . . . . iii. 11
Name of the breed . . iii. 9
Origin of . . . . . iii. 9
Prices . . . . . iii. 10
Society of . . . . . iii. 9
A typical shire . . . iii. 13
Veterinary inspection . . iii. 9
Shirreff, Mr, on cross-fertilisation of grain . . . . . ii. 105

Shocking, stocking or, grain . . ii. 185
Shoddy as manure . . . . . i. 488
Shoeing horses . . . . . iii. 323
Shorthorn cattle . . . . . iii. 82
Attributes of the breed . . iii. 86
Beef production . . . . iii. 86
For crossing purposes . . . iii. 87
Dexter-Shorthorn . . . . iii. 135
Early improvers . . . . iii. 82
Exports of . . . . . iii. 89
Herd-Books . . . . . iii. 89
The ideal Shorthorn . . . iii. 85
Later improvers . . . . iii. 84
Lincolnshire Red . . . . iii. 94
Management in dairy herds . iii. 93
Management of herds . . . iii. 89
Milking properties . . . iii. 88
Shorthorn Society . . . iii. 89
Short-wool and Down breeds of sheep iii. 162
Shovel, corn . . . . . ii. 227
" dung . . . . . i. 512
" lime . . . . . i. 513
Shows, preparing cattle for . . iii. 373
Showyard honours . . . . iii. 375
Shrew, the . . . . . ii. 430
Shropshire sheep—
Early types . . . . . iii. 164
Feeding boxes . . . . iii. 169
Management . . . . iii. 165
Mating rams and ewes . . . iii. 167
Merits of the breed . . . iii. 165
System of ear-marking . . iii. 166
Sickle or "hook" . . . . ii. 169
Sieve, milk- . . . . . ii. 488
" corn . . . . . ii. 226
Silica unnecessary for cereals . . ii. 7
" in soils . . . . . i. 304
Silos . . . . . ii. 289
Simplex pump . . . . . i. 160
Singeing horses . . . . . iii. 323
Singling and hoeing turnips . . ii. 352
Skim-milk cheese . . . . ii. 510
Skimmer, cream- . . . . ii. 489
Skylark, the . . . . . ii. 440
Sky-lights, specification for . i. 238, 242, 243
Skye ponies . . . . . iii. 53
Slag, basic or "Thomas" . . . i. 499
Slaking lime . . . . . i. 364
Slater-work, specifications for . i. 240, 243
Sleepy cream . . . . . ii. 499
Sliding scale of rent . . . . i. 268
Slime fungi . . . . . ii. 417
"Slipcote" cheese . . . . ii. 514
Sluge . . . . . ii. 472
Sluices, troughs and . . . . ii. 220
Small's plough . . . . . i. 381
Smearing sheep . . . . . iii. 387
Smut in barley . . . . . ii. 416
" in oats . . . . . ii. 416
" in wheat . . . . . ii. 416
Snails . . . . . ii. 472
Snow . . . . . ii. 69
Hedges injured by . . . i. 95
Keeps land warm . . . . ii. 69
And soil temperature . . . i. 262
In spring . . . . . ii. 59
Uses and drawbacks of . . ii. 69
Water and rain . . . . ii. 69
Snowfalls, gauging . . . . i. 28
Soda, nitrate of . . . . . i. 488
" action of nitrate of . . . i. 491
" as a manure . . . . i. 329
" nitrate of, excels ammonium-salts . . . . . ii. 11
Soft cheeses . . . . . ii. 513

Soil . . . . . i. 297
Absorbing power of . . . i. 311
Accumulation of fertility . i. 322
Alumina in . . . . . i. 304
An unreliable custodian of manure i. 472
Analysis of . . . . . i. 305
And rotation . . . . i. 436
Ashes of the plants . . . i. 305
Available inorganic matter . i. 304
Bacteria . . . . . i. 311
For barley . . . . . ii. 133
Capillary, power of . . . i. 309
For carrots . . . . . ii. 394
Causes of infertility . . . i. 331
" of wetness in land . . i. 51
Chalking . . . . . i. 348
Chalky . . . . . i. 299
Character of good and bad . i. 266
" of, and manuring . i. 516
Chemical analysis essential . i. 307
" changes in the . i. 303
" substances in . . i. 302
Classification of . . . . i. 301
Clay . . . . . i. 298
Clayey loams . . . . . i. 298
Claying . . . . . i. 346
Climate and manuring . . . i. 518
And climate for clovers . . ii. 241
Colour of, and subsoils . . i. 310
Composition of clay and shell marls i. 349
Composition of the earth's crust . i. 306
Conserving manures in . . . i. 492
Constituents . . . . i. 302
Density and volume weight . . i. 309
Depth of . . . . . i. 300
Different kinds . . . . . i. 298
Discriminating, by plants . . i. 312
Distribution of plant-food in . i. 320
" of plants . . i. 316
Drainage and temperature . . i. 263
" varying with . . . i. 53
And drainage-water experiments . ii. 3
Drift . . . . . i. 18
Dung beating . . . . . i. 471
Effect of, on milling property of oats ii. 141
Effects on, by irrigation . . i. 355
Evaporation from . . . i. 309
Examining . . . . . i. 265
" for drainage . . i. 53
Exhaustion by crops and stock . i. 326
Fertility of . . . . . i. 317
For flax . . . . . ii. 385
For irrigation . . . . . i. 356
Formation of . . . . . i. 18
Glacial drift or till . . . i. 301
Grass and, nitrogen . . . i. 434
Grasses for different . . . ii. 245
Gravelly . . . . . i. 299
For hops . . . . . ii. 377
Humus in . . . . . i. 303, 321
Influence of electricity on . . ii. 404
" of season and, on oats ii. 139
Inoculation of . . . . i. 324
Inorganic constituents of . . i. 303
" matter in plants . i. 307
Irrigating . . . . . i. 353
Kindly . . . . . i. 299
For kohl-rabi . . . . . ii. 393
Leguminous crops enrich, in nitrogen i. 324
" " and, nitrogen . i. 435
Liming . . . . . i. 361
Loamy . . . . . i. 298
For mangel . . . . . ii. 363
Manures for different . . . i. 516
Marling . . . . . i. 348

Soil—
Micro-organisms in . . . i. 325
Mixing, in claying lands . . i. 348
Mode of classification in India . i. 301
Nitrates in, production of . . i. 321
Nitrogen of the, and of atmosphere ii. 6
" per 1000 lb. of . . . i. 323
" phosphoric acid, and potash in i. 320
Nitrogenous manures which enrich i. 325
Of clay and sand . . . . i. 298
Organic matter in . . . . i. 302
Oxidation in different . . . i. 325
Oxide of iron in . . . . i. 304
" of manganese in . . . i. 304
Paring and burning . . . i. 349
Pastures on different . . . ii. 280
Pesty . . . . . i. 299
Percolation of water through . i. 309
Phosphatic manure, effect on . i. 328
Physical condition of the . . i. 318
" properties of . . . i. 308
Plant-food in . . . . i. 319
Position of, and subsoil . . i. 300
Power of, to retain manures . i. 492
Proportion of good and bad . i. 266
Relation of plants to . . . i. 315
" to strata . . . . i. 19
" to water . . . . i. 319
Residual . . . . . i. 301
Resources of the, and manuring . i. 449
Restoration of fertility by manuring i. 328
Retaining water in drainage . . i. 46
Retention of manures . . . i. 329
At Rothamsted . . . . ii. 2
Sandy . . . . . i. 298
Sandy loams . . . . . i. 299
Section of, and subsoil . . . i. 300
Signs for *faults*, by Bombay revenue i. 302
Silica in . . . . . i. 304
Smashing up the, in ploughing . i. 399
Snow and, temperature . . i. 262
Solubility of phosphates and potash in i. 322
Sources of fertility in . . . i. 319
Specific gravity of . . . i. 24
For strawberries . . . . ii. 400
Structure of . . . . . i. 308
Subsoil . . . . . i. 297
Temperature of . . . . . i. 310
" of, and atmosphere i. 262
" and drainage . . i. 47
Texture of . . . . . i. 308
Transported . . . . . i. 301
For turnips . . . . . ii. 328
Uncultivated . . . . . i. 266
Utilisation of air nitrogen by plants in . . . . . i. 332
Varying methods of ploughing to suit . . . . . i. 391
Ventilation of the . . . i. 49
For vetches . . . . . ii. 368
Virgin . . . . . i. 433
Water a factor in environment . i. 316
Weeds in . . . . . i. 312
What plants withdraw from the . i. 306
"Soiling" cattle . . . . iii. 370
" horses . . . . iii. 321
Soluble phosphates or superphosphates i. 501
Sombrero or rock guano . . . i. 499
Somerset, Dorset or, horn sheep . . iii. 180
Soot . . . . . i. 491
Sorghum . . . . . ii. 376
" as forage crop . . . iii. 289
Sowers, broadcast . . . . ii. 123
" drill . . . . . ii. 124
" hand broadcast . . . . ii. 124
Sowing—
Advantages of drill- . . . ii. 159
Barley . . . . . ii. 131
Basket . . . . . ii. 122
Beans . . . . . ii. 148
Cabbages . . . . . ii. 371
Carrots . . . . . ii. 394
Cereals . . . . . ii. 115
Crimson clover . . . . ii. 375
Deep and shallow . . . . ii. 164
Different methods of, and germination ii. 157
Disadvantages of broadcast . . ii. 157
Flax . . . . . ii. 387
Grass seeds . . . . . ii. 247
Crops accompanying . . ii. 250
Hand-sowing . . . ii. 248
Harrow carriage . . ii. 249
Harrows . . . . ii. 248
Methods of sowing . . ii. 248
Rolling . . . . . ii. 249
Speed of the machine . . ii. 248
Time of sowing . . . ii. 247
Working wide harrows . . ii. 249
Kohl-rabi . . . . . ii. 393
Machines . . . . . ii. 123
Manure in drills . . . . i. 519
Manures by machines . . . i. 520
" separately . . . i. 509
Oats . . . . . ii. 136
Peas . . . . . ii. 153, 154
Permanent pasture . . . ii. 286
Potato seed . . . . . ii. 313
Root, in summer . . . . ii. 63
Rye . . . . . ii. 141
Sheet . . . . . ii. 122
With spring crops . . . ii. 250
Thick and thin . . . . ii. 161
Turnips . . . . . ii. 334
Wheat in autumn . . . . ii. 116
" in spring . . . . ii. 119
Sows, farrowing of . . . . iii. 217
South Devon cattle—
Description . . . . iii. 106
Early history . . . . iii. 105
Herd-Book Society . . . iii. 105
Management of . . . . iii. 107
Milking qualities . . . . iii. 107
Recent improvement . . . iii. 106
Weights . . . . . iii. 106
South Devon sheep . . . . iii. 154
Southdown sheep—
Characteristics . . . . iii. 162
Early improvers . . . . iii. 162
Management . . . . iii. 163
Soy beans . . . . . iii. 274
Spade—
Common . . . . . i. 350
Digging . . . . . i. 64
Dung- . . . . . i. 460
Flauchter- . . . . . i. 350
Spade-hind, duties of . . . . i. 7
Spademen, duties of . . . . i. 7
Sparrow, the house- . . . . ii. 439
" -hawk, the . . . . ii. 431
Spaying cows . . . . . iii. 343
Special and artificial manures . . i. 486
Specific gravity of milk . . . ii. 480
" of soils, rocks, minerals, and woods i. 24
" of turnips . . . . . ii. 327
" of urine . . . . . i. 477
" and volume weight of soils . . i. 309
Specifications—
Conditions of . . . . i. 229
For a modern stone steading . i. 236
For a steading for a farm of 500 acres i. 229

Specifications—
For drainage contract . . . i. 63
For piggeries . . . . i. 186
Of labourers' cottages . . . i. 241
Of model cottage erected at Raith i. 224
"Speedwell" crystal churn . . ii. 497
Spicing, salting and, hay . . . ii. 277
Spiders . . . . . ii. 458
Sporadic abortion . . . . iii. 334
Spouts, rain-water . . . . i. 160
Spraying, the Strawsoniser at work . ii. 409
Spring, ... ii. 57
Advancing field-work . . . ii. 60
Birds in, storms . . . . ii. 59
Cares of stock-owners in . . ii. 57
Cattle, disposing of fat . . ii. 59
Checking growth of turnips in . ii. 359
Cottage gardening in . . . ii. 59
Crops, sowing with . . . ii. 250
Dunging for potatoes . . . ii. 302
Evaporation in . . . . ii. 59
Evils of procrastination . . ii. 61
Farmer's duties in . . . ii. 58
" garden in . . . ii. 59
Field operations in . . . ii. 57
" -work in . . . . ii. 58
Letting of grass parks in . . ii. 59
Manured beans, sowing . . ii. 151
Preliminaries . . . . ii. 61
Rain in . . . . . ii. 59
Snow in . . . . . ii. 59
Sowing wheat in . . . . ii. 10, 119
Subdivision of farm-work . . ii. 60
Tillage for beans . . . . ii. 150
" for turnips . ii. 329, 332, 333
Varieties of, wheat . . . ii. 127
Vetches . . . . . ii. 368
Weather in . . . . . ii. 58
Winds in . . . . . ii. 58
Spring-tails or Collembola . . . ii. 466
Springs, draining . . . . i. 53
Sprouting in the stook . . . ii. 189
Squirrel, the . . . . . ii. 429
Stable-fly . . . . . iii. 422
Stable management, method of . . iii. 324
Stables . . . . . i. 167
Binding horses in . . . . i. 174
Boxes for horses . . . . i. 174
Corn-chest . . . . . i. 174
Dimensions of . . . . i. 167
Equipment . . . . . i. 167
Evils of impure air in . . . i. 170
Fire-clay mangers for . . . i. 173
Fittings, specifications for . . i. 239
Floors for . . . . . i. 169
Foaling-box . . . . . i. 174
Harness room . . . . i. 173
Hay-house . . . . . i. 174
Large *v.* small . . . . i. 168
Mangers, specification for . . i. 235
Metal mangers and racks . . i. 172
Stalls . . . . . i. 170
Swung bale *v.* travis partitions . i. 169
Temperature of . . . . i. 171
Travis for horses . . . . i. 169
Ventilation of . . . . i. 170
Windows . . . . . i. 167
Stacks—
Cutting thatch . . . . ii. 200
Drawn straw . . . . ii. 196
Eave . . . . . ii. 195
English custom of thatching . ii. 199
Ensilage . . . . . ii. 290
Field . . . . . ii. 202
Form of . . . . . ii. 194
Stacks—
Formation of . . . . i. 177
Forming the apex . . . ii. 197
Foundation for . . . i. 176; ii. 193
Heating . . . . . ii. 200
Height of . . . . . ii. 195
Lifters . . . . . ii. 273
Material for thatching . . . ii. 196
Measuring heat in . . . ii. 201
Method of thatching . . . ii. 197
Propping . . . . . ii. 200
Ropes . . . . . ii. 195
Roping . . . . . ii. 198
Size of . . . . . ii. 194
Straw for ropes . . . . ii. 196
Straw-rope making . . . ii. 195
Thatching . . . . . ii. 196
Thermometer . . . . i. 26
Topping . . . . . ii. 195
Trimming . . . . . ii. 194
Tying ropes . . . . . ii. 198
Ventilators . . . . . ii. 201
Winding straw-ropes . . . ii. 196
Stack-building, commencing . . ii. 193
" " process of . . . ii. 193
Stacking beans . . . . . ii. 209
Cereals . . . . . ii. 189
Hay . . . . . ii. 264
Peas . . . . . ii. 209
Poles for hops . . . . ii. 383
Preparing for . . . . ii. 189
Process of . . . . . ii. 189
Temporary, or "rickling" . . ii. 189
Stackyard, arranging a . . . ii. 193
" account . . . . . i. 253
" fencing the . . . . i. 175
" ground-plan of . . . i. 177, 179
" posts and fencing . . . i. 235
" roofed . . . . . i. 177
Stairs, specification for . . i. 239, 243
Stake-and-rice fence . . . i. 101
Stakes, charring . . . . i. 102
Stall divisions, specification for . i. 235
Stallion, number of mares to one . iii. 329
Stalls—
For cows . . . . . i. 155
For feeding cattle . . . i. 155
For horses . . . . . i. 168
Single and double . . . i. 155
Standards, wrought-iron . . i. 112
Starling, the . . . . . ii. 436
"Starter" for butter-making . ii. 493
"Starters" or pure-cultures . . ii. 504
State aid to agriculture . . . i. 37
" for agricultural education i. 30
Stathels . . . . . i. 176
Statics . . . . . i. 20
Statistics, milk . . . . . ii. 480
Steading. See also Farm buildings . i. 126
Combined arable and pastoral . i. 132
Compact pastoral . . . . i. 131
Corn at the . . . . ii. 210
For arable farming . . . i. 135
For carse farms . . . i. 136
For dairy farming . . . i. 147
For mixed husbandry . . . i. 136
For pastoral cattle farming . i. 130
For sheep and arable farming . i. 134
For suburban dairy farming . i. 151
" farming . . . i. 148
Forfarshire . . . . . i. 141
Hanging-doors in . . . . i. 181
Manure-pits at . . . . i. 463
Modern English . . . i. 139
" Scotch . . . . i. 139

Steading—
Plans of . . . . i. 130
Position of farmhouses and . . i. 189
Precautions against vermin in . i. 183
Preservation of wooden floors . i. 181
Principle in the construction of . i. 129
Public health regulations for . i. 130
Roofs of . . . . . i. 181
Situation of the . . . . i. 127
Specification for a, for 500 acres . i. 229
" . for a modern stone . i. 236
Suburban farming, with arable culture . . . . . i. 149
Truss-roofs . . . . . i. 182
Work in the, in winter . . ii. 66
Steam, condensing waste . . . i. 406
" food-preparing machinery . . iii. 356
" generators, tubular . . i. 409
" ploughs and diggers . . . i. 383
Steam cultivation . . . . i. 403
Advantages of steam-ploughing . i. 422
Double-engine system of . . i. 422
Injury by too deep ploughing . i. 421
Plough engines . . . . i. 423
Ploughing plant, cost of . . i. 423
Prejudice against steam-ploughing i. 421
Single-engine systems . . . i. 424
Steam-digging . . . . i. 427
Tackle for 1000 acres . . . i. 424
Weeds killed by digging . . i. 427
Steam-engine—
Boiler . . . . . i. 407
Compound . . . . . i. 413
Construction of, and action of steam i. 411
Different types of . . . . i. 414
Expansive action of steam in single i. 413
High pressure . . . . i. 406
Highland and Agric. Society's trials i. 418
Horizontal . . . . . i. 414
Portable . . . . . i. 415
Semi-portable . . . . i. 416
Simplicity in . . . . i. 418
Traction . . . . . i. 418
Vertical . . . . . i. 414
Steam-power . . . . . i. 21
Application of, to agriculture i. 403
For cleaning clay land . . . ii. 332
Coal as fuel . . . . . i. 404
Early days of . . . . i. 404
Other forms of . . . . i. 404
For threshing-machines . . ii. 216
Steelbow entry to farms . . . i. 277
Steeping flax . . . . . ii. 389
Stells—
For sheep . . . . i. 132; iii. 401
Concave . . . . . iii. 402
Circular . . . . . iii. 402
Inside . . . . . iii. 402
Forming plantation . . . iii. 401
Giving hay at . . . . iii. 402
Outside . . . . . iii. 401
Size of . . . . . iii. 402
Steps, fence . . . . . i. 120
Sterilisation of milk . . . . ii. 482
Sterilised milk bottles . . . ii. 482
Steward, duties of a farm . . . i. 6
Sties for brood-sows . . . . iii. 219
Stilton cheese . . . . . ii. 510
Stilts, length of plough . . . i. 373
Stoats . . . . . ii. 425
Stock-dove, the . . . . . ii. 436
Stock-owners, cares of, in spring . ii. 57
Stock—
Account . . . . . i. 256
Ailments of farm live . . . iii. 435
Stock—
Changing on pastures . . . iii. 363
Farm live . . . . . iii. 1
And fire . . . . . i. 280
Improvement of, in Ireland . i. 43
On carse farms . . . . i. 5
Quantity of dung per head of . i. 469
Table of pulse respiration and temperature . . . . iii. 499
Varieties of food for . . . iii. 269
Vetches, how fed to . . . iii. 288
Stock-breeding, principles of . . iii. 224
Stocking farms . . . . . i. 281
" a carse-land farm . . . i. 5
" a dairy-farm . . . . i. 5
" a pastoral farm . . . . i. 4
" of pastures . . . . . ii. 283
Stone drains . . . . . i. 58
" walls, dry . . . . . i. 107
Stones for road-metal . . . i. 124
" specification for hook . . i. 231
" " for dressing . i. 237, 241
Stony ground, trenching . . . i. 337
Stooking or shocking grain . . ii. 185, 188
Store cattle—
Ages of . . . . . iii. 359
Deficiency of . . . iii. 349
Management of . . . iii. 355
In partially open courts . . i. 167
On pastures . . . . . iii. 362
Winter feeding of . . . iii. 358
Winter housing of . . iii. 357
Store sheep in summer . . . iii. 382
Storing—
Cabbages . . . . . ii. 373
Carrots . . . . . ii. 395
Kohl-rabi . . . . . ii. 393
Mangels . . . . . ii. 366
Parsnips . . . . . ii. 396
Potatoes . . . . . ii. 321
Turnips . . . . . ii. 356
Wheat, ancient practice in . . ii. 95
Straight fences . . . . . i. 87
Strainer, creamery . . . . ii. 489
Straining post for wire field fences i. 110, 111
Straw . . . . . ii. 102
Ancient uses of . . . . ii. 104
Ash of . . . . . ii. 102, 103
Barley . . . . . ii. 103
Bean- and pea- . . . . ii. 148
Chaff as food . . . . iii. 287
Corn and, from high manuring . ii. 7
In farm buildings . . . i. 129
And hay elevator . . . ii. 215
As litter . . . . . iii. 322
Manurial value of . . . i. 467
Mixed with hay in drying . . ii. 269
Oat and rye . . . . . ii. 103
Outlet for flax . . . . ii. 391
Preparing and storing chaff . . iii. 287
Racks . . . . . i. 152
For ropes . . . . . ii. 196
Rope making . . . . ii. 195
Rope winding . . . . ii. 196
Thatch-making machine . . ii. 197
Trusser . . . . . ii. 215
Turnips and, for store cattle . iii. 360
Value of, in cattle-courts . . i. 162
Value of, as food . . . . iii. 286
Wheat . . . . . ii. 102
Yield of . . . . . ii. 104
Straw-barn . . . . . i. 178
" floor . . . . . i. 180
Strawberries . . . . . ii. 399
Strawsoniser, the . . . . ii. 409

Stream, horse-power in a . . ii. 218
Streamlet churn . . . ii. 497
Stripper harvester . . . ii. 182
Stripping cows . . . . iii. 341
" turnips . . . ii. 358
Stubble, ploughing, land . . i. 398
" rake . . . . ii. 185
Students. See Farm pupils . i. 1
Sub-letting, conditions as to . i. 276
Subsidiary farm crops . . ii. 392
Cabbages . . . ii. 393
Carrots . . . . ii. 393
Flowers . . . . ii. 401
Fruit . . . . ii. 400
Hemp culture . . ii. 402
Kohl-rabi . . . ii. 392
Lavender . . . ii. 402
Parsnips . . . . ii. 396
Red-clover seed . . . ii. 401
Rhubarb . . . ii. 399
Vegetables . . . ii. 397
Woad . . . . ii. 403
Subsoil . . . . . i. 297
And trench-ploughing . . i. 400
Colour of . . . . i. 310
Examining . . . . i. 265
Influence of . . . . i. 300
Injurious ingredients in . i. 401
Subsoiling . . . . i. 399
Suburban dairy-farming, steadings for i. 151
" farming . . . . i. 5
" " capital for . . i. 5
" " steadings for . . i. 148
" " with arable culture . i. 149
Suction gas-producer plant . . i. 430
Suffolk horse—
Characteristics . . . iii. 29
Management . . . iii. 31
Measurements . . . iii. 30
Society . . . . iii. 30
Suffolk sheep . . . . iii. 176
Sugar-beet . . . . ii. 403
" as food for dairy cows iii. 281
Sugar, value of . . . . iii. 289
Sulphate of ammonia . . . i. 490
" and nitrate of soda compared . i. 491
Sulphuric acid and nitrogen from rain-water . . . . . i. 48
Summer . . . . . ii. 61
Atmospherical complications in . ii. 61
Beneficial influence of dew . ii. 62
Calendar and agricultural seasons ii. 62
Care of horses in . . . . iii. 321
Cattle, disposal of fat . . ii. 63
Culture of barley . . . ii. 135
" of beans . . . ii. 152
" of oats . . . ii. 139
" of peas . . . ii. 154
" of wheat . . . ii. 128
Dairying in . . . . ii. 63
The farmer's duties in . . ii. 64
Feeding dairy cows in . . iii. 346
Forage crops, disposal of . ii. 63
Grazing stock in . . . ii. 63
Haymaking in . . . . ii. 63
Horses in . . . . ii. 63
Hours of labour in . . ii. 63
Insect attacks in . . . ii. 63
Light in . . . . ii. 62
Rain . . . . . ii. 62
Repairing fences . . . ii. 63
Rest from field-work in . ii. 64
Root sowing in . . . ii. 63
Sheep, disposal of fat . . ii. 63
Sheep in . . . . iii. 382
Summer—
Summary of farm-work in . ii. 62
Thunderstorms . . . i. 28
Top-dressing of manures in . ii. 63
Weaning lambs in . . ii. 63
The weather . . . . ii. 61
Weed attacks in . . . ii. 63
Superphosphates . . . . i. 502
" for barley . . . . ii. 134
" for turnips . . . ii. 345
Surface-drains . . . . i. 85
Surface-manuring . . . i. 515
Survey, geological . . . i. 19
Surveying ground for planting hedges i. 92
" preliminary, for drains . i. 55
Sussex cattle—
Management of . . . iii. 110
Standard description . . iii. 108
Weights and early maturity . iii. 109
Swallow, the . . . . ii. 437
Swamp irrigation . . . i. 360
Swartz system of raising cream . ii. 489
Swathe-turner . . . . ii. 259
Swede, seed of . . . . ii. 73
Swedes . . . . ii. 325
Swimming-bath for sheep . . iii. 387
Swine, administering medicine to iii. 496
" ailments of . . . iii. 490
" and their management . iii. 210
" management of . . iii. 217
" period of gestation . . iii. 236
Swine, breeds of . . . . iii. 8, 210
Berkshire . . . . iii. 213
Large black pigs . . . iii. 214
Large white breed . . . iii. 210
Large white Ulster pig . . iii. 212
Lincolnshire curly coated pigs iii. 215
Middle white . . . iii. 211
Other types of pigs . . iii. 217
Small breeds of pigs . . iii. 216
Tamworth pig . . . iii. 214
Swing churn . . . . ii. 497
" ploughs . . . . i. 389
" tress . . . . i. 375, 378
Switching-bill . . . . i. 95
" hedges . . . . i. 95
Swung bale *v.* travis partitions . i. 169
Systems of breeding . . . iii. 228

Tackle for steam cultivation . . i. 424
Tailing, topping and, turnips . ii. 359
Tamworth pig . . . . iii. 214
Tank, liquid manure . . . i. 159, 480
Tares, harvesting. See also Vetches . ii. 209
Taylor's stack ventilator . . ii. 202
Tedders injuring clover-hay . ii. 260
Tedding . . . . . ii. 260
" swathe-turning and . . ii. 259
Telegony . . . . . iii. 227
Temperature—
Of cream for churning . . ii. 494
Of the dairy . . . . ii. 477
Drainage and soil . . i. 47, 263
Duration of vegetation and . i. 262
Elevation and . . . . i. 263
Greenwich mean . . . i. 26
Irrigation and soil . . . i. 355
Mean and actual . . . i. 261
Of shallow pans for creaming . ii. 487
Of soil and atmosphere . . i. 262
Of soils . . . . . i. 310
Of stables . . . . i. 171
Plant growth and . . . i. 262
Snow and soil . . . . i. 262
Ventilation and, on milk yield . iii. 346

Tenancy. See also Lease . . . i. 267
Compensation for disturbance . i. 268
"Covenanted" rent . . . i. 269
Deductions for bad condition . i. 269
Fixed money-rents . . . i. 269
Grain-rent . . . . . i. 268
In Ireland . . . . . i. 268
Interest, profit, and rent . i. 269
Mixed rents . . . . . i. 268
Offering for a farm . . . i. 270
Produce-rent . . . . . i. 268
Rent and land value . . . i. 269
Sliding-scale in rent . . . i. 268
Term of . . . . . i. 267
Yearly . . . . . i. 268
Tenant, outgoing and incoming . . i. 278
" repaying, for cartages . . i. 270
Terms of entry to farms . . . i. 277
Testing percentage of cream in milk . ii. 479
Texture of soils . . . . . i. 308
Thatch, cutting . . . . . ii. 200
" potato-shaws as . . . . ii. 323
Thatch-making machine . . . ii. 197
Thatching peas and beans . . . ii. 209
" procesa of. See also Stacks . ii. 195
" turnip-store . . . . ii. 361
Theory of rain . . . . . i. 28
Thermometers . . . . . i. 25
" dairy . . . . . ii. 477
" Fahrenheit . . . . . i. 26
" minimum . . . . . i. 26
" stack . . . . . i. 26
Thinning carrots . . . . . ii. 395
" and hoeing kohl-rabi . . . ii. 393
" -machines . . . . . ii. 353
" of turnips . . . . . ii. 327
Thistle, seed of field- . . . . ii. 79
"Thomas" slag . . . . . i. 499
Thorn hedges . . . . . i. 95
Thoroughbred horse . . . . iii. 34
" for Hunter breeding . . . iii. 35
Thousand-headed kale . . ii. 374; iii. 282
Thraving . . . . . ii. 170
Threshing grain in winter . . . ii. 67
" by outgoing tenants . . . i. 278
" and winnowing corn . . . ii. 222
Threshing-machine, an ancient . . ii. 210
Care in feeding . . . . ii. 223
Hand . . . . . ii. 216
Hands required for . . . ii. 213
Horse-power for . . . . ii. 221
Irregular driving . . . . ii. 223
Motive power for . . . . ii. 216
Portable . . . . . ii. 213
Machine, position of, in steading . i. 129
Preparing for . . . . ii. 223
Removing straw . . . . ii. 223
Safety druma . . . . ii. 215
Saving of labour . . . . ii. 212
Scotch . . . . . ii. 211
Straw and hay elevator . . ii. 215
Straw-trusser attached to . . ii. 215
Water-power for . . . . ii. 217
Throstle, the . . . . . ii. 436
Throw-crooks . . . . . ii. 195, 196
Thrush, the . . . . . ii. 436
Thunderstorms and haymaking . . ii. 263
" summer . . . . . i. 28
Ticks in sheep . . . . . iii. 433
Tile drains . . . . . i. 58
Till soil . . . . . i. 18, 301
Tillage for barley . . . . . ii. 131
For carrots . . . . . ii. 394
Drainage facilitating . . . i. 50
For flax . . . . . ii. 385
Tillage—
For hay . . . . . ii. 251
For kohl-rabi . . . . . ii. 393
Land, mole-draining . . . i. 74
For mangels . . . . . ii. 363
And manuring . . . . . i. 517
For peas . . . . . ii. 153
Soil and, for potatoes . . . ii. 296
Spring, for beans . . . . ii. 150
For turnips . . . . . ii. 328
Tillering . . . . . ii. 161, 165
" multiple stems or . . . ii. 157
Timid animals, protection to . . i. 154
Timothy hay, cutting . . . . ii. 263
" head of, with ergots . . . iii. 334
" grass, seed of . . . . ii. 84, 239
Tip-cart, farm . . . . . ii. 349
Titmice . . . . . ii. 437
Tobacco . . . . . ii. 403
Tomato root-rot . . . . . ii. 471
Tools for dyke-building . . . i. 106
" for weeding and planting hedges i. 91, 103
Topping and tailing turnips . . ii. 359
Traction engine . . . . . i. 418
Tractors, motor . . . . . ii. 182
Tracts for foundations, specification for i. 237
Transplanting seed . . . . ii. 166
Transported soils . . . . i. 301
Travis for horse stables . . . i. 169
Treacle for breeding stock . . . iii. 278
Treatment of farm horses . . iii. 313
Trees and hedges. . . . . i. 94
" swing- . . . . . i. 375
" winter washing of fruit- . . ii. 457
Trefoil, seed of . . . . . ii. 76
Trench-planting hedges . . . i. 91
Trench-ploughing . . . . i. 400
Subsoil plough . . . . i. 401
Subsoiling . . . . . i. 401
Trenching stony ground . . . i. 337
" hand . . . . . i. 402
" waste land . . . . . i. 337
Trimming stacks. . . . . ii. 194
Tropophytes . . . . . i. 316
Troughs—
And hatks . . . . . i. 239
And sluices . . . . . ii. 220
Cattle . . . . . i. 151
Concrete . . . . . i. 151
Pig . . . . . iii. 223
Position of water- . . . . i. 153
Specification for . . . . i. 235-239
Turnip sheep-feeding . . . iii. 394
Water- . . . . . i. 153
Truss for iron roof . . . . i. 177
" roofs of steadings . . . i. 182
Trussor, straw- . . . . . ii. 215
Tsetse-flies . . . . . iii. 421
Tubes, Galloway. . . . . i. 408
Tuberculosis of poultry . . . iii. 255
Tubular milk-cooler . . . . ii. 483
" steam-generators . . . i. 409
Tufted hair-grass, seed of . . . ii. 89
Tulip-root of oat, or segging . . ii. 471
Tupping season . . . . . iii. 390
" fertility in sheep . . . iii. 390
" flushing ewes . . . . iii. 390
" management in . . . . iii. 390
Turbine, the . . . . . ii. 221
" -driven pasteuriser . . . ii. 481
Turf fence . . . . . i. 103
" removing . . . . . i. 337
Turkeys . . . . . iii. 245
Turnip-cutter, Garduer's . . . iii. 395
Turnip-picker . . . . . iii. 395

Turnips . . . . . ii. 324
Advantages of . . . . . ii. 324
" of raised drills . . ii. 334
" of storing . . . iii. 279
After cultivation . . . . ii. 356
Analysis of . . . . . ii. 394
Application of manure for . . ii. 348
Artificial manure alone . ii. 348, 351
Atmospheric nitrogen for . . ii. 342
Autumn cleaning . . . . . ii. 331
" dunging and ploughing . ii. 332
" and winter ploughing . ii. 329
Basic slag for . . . . . ii. 346
" *v.* superphosphate . ii. 350
Broadcast sowing of . . . . ii. 335
Care in thinning . . . . . ii. 327
Care in use of mineral phosphates ii. 345
Cart for dung on steep land . . ii. 349
Carting . . . . . ii. 369
" dung into drills . . ii. 348
Cheapest phosphate for turnips . ii. 344
Checking growth in spring . . ii. 359
Clay soils unsuitable for . . ii. 328
On very strong clays . . . ii. 333
Climate and soil to be considered ii. 345
Climatic influences on . . . ii. 326
Common . . . . . ii. 325
Composition of . . . . . iii. 279
Consolidating the drill-top . . ii. 337
Consumed on the ground by sheep ii. 357
Cross-cultivation . . . . . ii. 332
Cutter-cart . . . . . iii. 395
Cutting for cattle . . . . iii. 355
" for sheep . . . . iii. 395
Daily allowance for cattle . iii. 365
Dependence on manure . . ii. 339
Depth of the drill . . . ii. 335
" of seed . . . . . ii. 339
Desirability of economising . . iii. 280
Diamond-back moth . . . ii. 464
Disadvantage of raised drills . ii. 334
Distance between plants . . ii. 354
Distribution of the plants . ii. 327
Drill-plough . . . . . ii. 334
" -sower . . . . . ii. 337
" for sowing on the flat . . ii. 338
Drilling on the flat . . . ii. 335
" manure and seed . ii. 337
Dung . . . . . ii. 348
" spreading apparatus . . ii. 349
Is dung essential for . . . ii. 346
Dunging and sowing in drills . ii. 336
Earthing-up . . . . . ii. 356, 362
Economise . . . . . iii. 359
Elements absorbed by roots . ii. 340
" in manure for . . ii. 340
English practice of manuring . ii. 342
Excess of potash injurious . . ii. 343
An exhausting crop . . . ii. 339
Experiments at Carbeth . . ii. 342
" in north of England ii. 350
" in south of England ii. 350
" in north of Scotland ii. 350
" at Pumpherston . ii. 37-40
Farmyard manure for . . . ii. 346
Fine grinding in manure . . ii. 350
Finger-and-toe, or club-root . ii. 49, 417
As food for stock . . . . iii. 279
The force employed . . . ii. 336
Forking out weeds . . . . ii. 333
Gall-weevil . . . . . ii. 463
Growing may be overdone . . ii. 324
" roots in squares . . ii. 355
Grubbing or cultivating in spring ii. 332
Half-ploughing . . . . ii. 332

Turnips—
Hand-hoes . . . . . ii. 353
Harrowing turnip-land . . ii. 330
Heavy dressings . . . . ii. 347
Hoeing—
Advantages of drills . ii. 355
Care in . . . . . ii. 356
Drill-harrowing or horse-hoeing ii. 352
" scarifier . . . ii. 352
Good and bad hoeing . . ii. 353
Hand-hoeing in flat rows . ii. 353
Harrowing across flat rows . ii. 352
Hoeing-matches . . . ii. 353
Influence of weather . ii. 352
Medium and large roots . ii. 355
Process on drills . . . ii. 353
Speed of hoers . . . ii. 353
Thinning by hand . . . ii. 354
Transplanting plants . . ii. 354
Ill-shaped . . . . . ii. 326
Insect attacks on . . . . ii. 326
Introduction of . . . . . ii. 324
" of drill-sowing . ii. 334
Irregularity in growth of . . ii. 355
Keeping properties of . . . ii. 357
Lifters . . . . . ii. 360
Lifting appliances . . . ii. 358
Manure injuring seeds . . . ii. 338
Manures for turnips and beans . ii. 33
Manuring . . . . . ii. 339
Mildew of . . . . . ii. 411
Mineral phosphates . . . ii. 345
Mode of pulling . . . . ii. 359
Moderate dressings of dung . ii. 347
Moth . . . . . ii. 465
Mud-beetle . . . . . ii. 462
New varieties . . . . . ii. 325
Nitrogen for . . . . ii. 341, 342
Normal conditions in preparing land ii. 329
Number per acre . . . . ii. 327
Opening and closing drills . ii. 337
Order of using . . . . ii. 326
Overworking land injurious . . ii. 333
Pests . . . . . ii. 356
Phoma fungus . . . . ii. 414
Phosphates for . . . . ii. 343
Pits in the field . . . . ii. 361
Ploughing or grubbing . . ii. 330
Potash for . . . . . ii. 343
Preparing clean land . . . ii. 333
" foul clay land . ii. 331
Prevailing intervals between . ii. 354
" systems of growing . ii. 329
Produce of different varieties . ii. 325
Proportion of leaf and root . . ii. 326
Pulverising ploughs . . . ii. 330
Pumpherston, manuring at ii. 37, 40
Quantities of manures for . . ii. 347
Quantity of roots to be left for sheep ii. 357
" of seed required . . ii. 338
Raised drills on strong clays . ii. 335
Recouping the soil . . . ii. 344
Removing weeds . . . . ii. 330
Rothamsted trials . . . . ii. 342
Sawfly . . . . . ii. 466
Scottish dressings of manure . ii. 347
Seed of . . . . . ii. 73
Seed-drill . . . . . ii. 337
Selection of seed . . . . ii. 338
Sheep on . . . . ii. 67; iii. 391, 396
Shelter for sheep on . . . iii. 397
Simultaneous drilling and sowing ii. 336
Singling and hoeing . . . ii. 352
Soils for . . . . . ii. 328
Southern customs of sowing manure ii. 349

Turnips—
Southern dressings . . . ii. 348
Sowing . . . . . ii. 334
" artificial manure . . ii. 349
Specific gravity of . . ii. 327
Stale seed-bed undesirable . . ii. 336
Stores . . . . . i. 152
Storing . . . . . ii. 356
And straw for store cattle . . iii. 360
Stripping . . . . . ii. 358
Supplementing dung . . . ii. 346
Swedes . . . . . ii. 325
For table use . . . . . ii. 398
Taking roots from the store . . ii. 361
Temporary storing on lea . . ii. 361
Thatching store . . . . . ii. 361
Thick and thin sowing . . . ii. 338
Tillage of land for . . . . ii. 328
Top-dressing . . . . . ii. 350
Topping and tailing . . . . ii. 359
Tops as food . . . . ii. 398; iii. 281, 393
Trimming knife . . . . . ii. 359
Trough for courts . . . . i. 151
Uncertainties in manuring . . ii. 340
Varieties of . . . . . ii. 325
Water drill . . . . . ii. 337
" and dry drills compared . ii. 338
Weeds . . . . . ii. 331
Weight of . . . . . ii. 327
Welsh trials in manuring . . ii. 351
White rot of . . . . . ii. 418
Width of drills . . . . . ii. 334
" of rows . . . . . ii. 335
Yield and quantity of dung . . ii. 347
Turnstile . . . . . i. 121
Tutor-farmers . . . . . i. 1, 2
Twigs, laying young, for hedges . i. 101

Udder-clap among ewes . . . iii. 381
Udder, cow's, its structure . . iii. 340
Uist ponies . . . . . iii. 53
Umbelliferous "seeds" . . . ii. 80
Undecorticated cotton-cake, value of . iii. 277
Undershot water-wheels . . . ii. 217
Unexhausted value of manures . . i. 330
Unit value of manures . . . i. 507
United States, weather forecasts in . i. 30
Uredineæ . . . . . ii. 414
Urine. See also Liquid manure . i. 475
Cesspools, specification for . . i. 237
Changes through decomposition . i. 477
Composition of . . . . . i. 477
" of, of different animals i. 475
" of saline and mineral ingredients . . . . . i. 477
Conditions influencing . . . i. 476
Decomposition of . . . . i. 476
Fixing ammonia . . . . i. 476
Fresh and stale . . . . . i. 476
" injurious to vegetation . i. 485
Manurial value of . . . iii. 304
Pumping, on dung . . . i. 464
Specific gravity of urine . . i. 477
Utilisation of surplus . . . i. 482
Useful flies . . . . . ii. 469
Ustilagneæ, the . . . . . ii. 416

Value of foods for maintenance . . iii. 299
" unit, of manures . . . i. 507
Valuing crops . . . . . i. 278
" sheep-stocks . . . . i. 279
" of unexhausted manures . i. 330
Vane, specification for . . . i. 240
Vapour, aqueous . . . . . i. 27
" weight of . . . . . i. 27

Varieties of food for stock . . . iii. 269
Vat, milk- . . . . . ii. 502
Vegetable casein in beans, peas, and lentils . . . . . iii. 273
Vegetation—
Duration of, and temperature . i. 262
Fresh urine injurious to . . i. 485
Moisture and, in irrigation . . i. 354
Preventing the loss of nitrates . i. 473
Zones of . . . . . i. 316
Ventilation of byres . . . . i. 157
In churning . . . . . ii. 499
Evils of impure air . . . . i. 170
How to be provided . . . i. 171
Of poultry houses . . . . iii. 246
Of stables . . . . . i. 170
Of the soil . . . . . i. 49
Specification for . . . . i. 234, 240, 242
And temperature on milk yield . iii. 346
Ventilators, stack . . . . . ii. 201
Vents, specification for . . . i. 242
Verandah of dairy . . . . . ii. 476
Vermin, precautions against, in barns . i. 183
Vertebrates, classification of . . i. 16
Vertical boiler . . . . . i. 408
" " and engine . . . i. 415
Vetches . . . . . ii. 368
As forage crop . . . . . iii. 288
Harvesting . . . . . ii. 209
How fed to stock . . . . iii. 288
Manuring . . . . . ii. 369
Spring . . . . . ii. 368
Utilising . . . . . ii. 368
Winter . . . . . ii. 368
Veterinary science . . . . . i. 17
" ailments of farm live stock . iii. 435
" recipes . . . . . iii. 493
Vilmorin's classification of wheat . ii. 93
Virgin soils . . . . . i. 433
Voelcker and Hall's manurial tables . iii. 311
Voles . . . . . ii. 428

Wages. See Farm servants . . i. 289
Waggon, farm . . . . . ii. 191
Wagtails, water- . . . . . ii. 437
Wall, shelter from, and plantation . i. 89
Wallace's hay-sledge . . . . ii. 266
" milking-machine . . . iii. 345
Walls, dry-stone . . . . . i. 105
" specification for . . . . i. 241, 237
Warping . . . . . i. 360
Waste land . . . . . i. 335
A Mid-Lothian example of improving i. 344
An Irish example . . . . i. 339
Cropping new land . . . i. 339
Crops from . . . . . i. 339
Depth and cost of trenching i. 337
Draining . . . . . i. 337
Improvements at Boon . . i. 341
Improving . . . . . i. 335, 340
" at Glenbuck . . i. 344
" hill pasture . . i. 343
Laying to pasture . . . i. 340
Levelling . . . . . i. 338
Levelling-box . . . . . i. 338
Methods of . . . . . i. 336
Original condition of . . . i. 339
Process of reclamation . . . i. 339
Reclaiming plantation ground . i. 337
Removing turf . . . . . i. 337
Renewing pasture . . . . i. 340
Rules for land improvement . i. 335
Scottish example . . . . i. 336
Trenching . . . . . i. 337
" stony ground . . i. 337

Waste land—
Trials in Scotland . . . i. 346
" in Northumberland . . i. 345
Water—
Access to, in enclosing fields . i. 89
As a prime factor in environment i. 316
Channels in ploughed land . . i. 398
Cistern . . . . . i. 153
Course, planting hedges along . i. 94
Level test holes . . . . i. 53
Meadow catch-work . . . i. 358
" for Highland districts . i. 355
" irrigation . . . i. 355
Percolation of, through soils . i. 309
Quantity required for irrigation . i. 357
Relation of soil to . . . i. 319
Requirements of animals . . iii. 296
For sheep . . . . . iii. 382
Soft, best for boilers . . . i. 411
Soils retaining, in drainage . i. 46
Spouts, defective . . . . i. 465
Supply to cattle courts . . i. 152
" for irrigation . . . . i. 357
Table in drained and undrained land i. 49
Tank, specification for . . . i. 231
Troughs . . . . . i. 153
" position of . . . i. 153
" specification for . . i. 235
Waste steam condensing . i. 406
Water-ballast rollers . . . ii. 143
" -channels in ploughed land ii. 66
" -courses, finishing processes . ii. 118
" drill for turnips . . . . ii. 337
" -furrows, formation of . ii. 137
" " under drainage *v.* ii. 127
" " inland . . . ii. 126
" meadows, time for irrigating . ii. 66
Water-brush . . . . . iii. 315
Water power for threshing-machines . ii. 216
" -rat or vole . . . . . ii. 428
" -shrew . . . . . ii. 431
" -supply, measuring the . ii. 217
" " to pastures . . ii. 284
Water-wagtails . . . . ii. 437
Water-wheel . . . . . ii. 217
" speed of bucket . . ii. 221
Watering horses . . . . . iii. 313
" -pools . . . . . i. 109
Watson's ventilator . . . i. 158
Way-bread, seed of . . . ii. 77
Wayfares and fences . . . i. 88
Way-going crops . . . . i. 277
Disadvantages of selling system i. 278
Selling . . . . i. 278
Weaning calves . . . . . iii. 354
" foals . . . . . iii. 328
" lambs . . . . ii. 63; iii. 386
Weasel, the . . . . . ii. 425
Weather—
Autumn, and field operations . ii. 65
Effects of, and manures on barley ii. 22
And field operations in winter ii. 66
Forecasts . . . . . i. 20
Forecasts in the United States . i. 30
Foretelling . . . . . i. 30
Germination of barley and the ii. 132
And harvest . . . . . ii. 65
And haymaking . . . . ii. 253
Haymaking controlled by the ii. 258
In spring . . . . . ii. 58
In summer . . . . . ii. 61
In winter . . . . . ii. 68
And work . . . . . ii. 57
Wechts, barn, or baskets . . ii. 225, 226
Wedge-and-shoulder drains . i. 57
Weed-cleaning, conditions as to . . i. 275
Weed-hook . . . . . ii. 129
Weeding cereal crops . . . ii. 129
" flax . . . . . ii. 388
" hedges . . . . . i. 103
Weeds—
Attacking, in summer . . . ii. 63
Cleaning of the land from . . i. 436
Collecting . . . . . i. 444
Disposing of . . . . . i. 444
Found in soils . . . . i. 312
In hedges . . . . . i. 94
In pastures . . . . . ii. 284
Killed by steam-digging . . i. 427
On bare fallow . . . . i. 444
On turnip land . . . ii. 330, 333
Weevils—
Bean . . . . . ii. 459
Black vine . . . . . ii. 467
Cabbage root gall . . . . ii. 448
Corn and rice . . . . . ii. 455
Pea and bean . . . . . ii. 459
Raspberry . . . . . ii. 467
Turnip and cabbage gall- . . ii. 463
Weighing-machines . . . ii. 230; iii. 410
Weight and average composition of crops . . . . . ii. 326
Weight of barley . . . . ii. 97
" and specific gravity of milk . ii. 480
" of oats . . . . . ii. 99
" of rye . . . . . ii. 101
" of turnips . . . . . ii. 327
" of wheat . . . . . ii. 94
Welsh black cattle—
Characteristics . . . . iii. 122
Improvement required . . iii. 123
Management of . . . . iii. 124
Maturity and weight . . iii. 122
Milking properties . . . iii. 123
Welsh cob, type of a . . . . iii. 46
" pony . . . . . iii. 45
" sheep . . . . . iii. 198
Wensleydale cheese . . . . ii. 513
" sheep . . . . iii. 154
West Highland cattle . . . iii. 116
Wheat—
After beans . . . . . ii. 119
After grass . . . ii. 119, 127
After potatoes . . . . ii. 119
Ancient practice in storing . . ii. 95
Antiquity of, cultivation . . ii. 95
Art of sowing . . . . ii. 122
Autumn . . . . . ii. 128
Autumn and winter weather for . ii. 13
Black rust of . . . . ii. 414
Braird, harrowing the . . . ii. 250
Breeding on Mendel's principles . ii. 110
Broadcast-sowers . . . . ii. 123
Bulb fly . . . . . ii. 451
Bunt of . . . . . ii. 416
Classification . . . . ii. 91
Colour of . . . . . ii. 91
Crop values . . . . . ii. 90
Cropping rank . . . . ii. 129
Date of spring sowing . . . ii. 119
Double-furrow plough . . . ii. 120
Drill-sowers . . . . . ii. 124
Dung for . . . . . i. 515
Ear-cockle . . . . . ii. 470
Experiments at Rothamsted . ii. 3
" at Woburn . . ii. 43
Fallow . . . . . ii. 117
For flour . . . . . ii. 93
Flowering season . . . . ii. 130
As food . . . . . iii. 269

Wheat—
Frost throwing out plants . . ii. 118
Grubbing for . . . . ii. 117
Hand broadcast sowers . . ii. 124
Harrowing . . . . ii. 118, 125
Hoeing drilled . . . . ii. 129
Judging . . . . ii. 93
Kernel and husk of . . . ii. 95
Land for spring . . . . ii. 119
Late varieties of . . . . ii. 128
Limits of, culture . . . ii. 95
Manuring of. See Rothamsted . ii. 3, 128
Midge . . . . . ii. 452
Number of grains in a bushel . ii. 94
One-hand sowing . . . . ii. 121
Origin of . . . . . ii. 95
Over-luxuriance in autumn . . ii. 128
Pickling . . . . . ii. 130
Placing sacks in the field . . ii. 120
Plant in the state of germination . ii. 157
Ploughing for . . . . ii. 117
Preserving, in granaries . . ii. 94
Roots of sown . . . . ii. 165
Quantity of ash in an acre of . ii. 95
Quantity of seed for . . . ii. 118
Reaping . . . . . ii. 188
Relation of ear and grain . . ii. 93
Riddle . . . . . ii. 225
Rolling . . . . . ii. 118
Rust in, description of figures . ii. 419
Scythe unsuitable for reaping . ii. 188
For seed . . . . . ii. 94
Seed-basket . . . . . ii. 121
" carrier . . . . . ii. 121
" sacks . . . . . ii. 121
Self-binders for reaping . . ii. 188
Sheaves for . . . . . ii. 188
For sheep . . . . . iii. 269
Smut . . . . . ii. 416
Sowing in autumn . . . ii. 117
" in spring . . . . ii. 119
" machines . . . . ii. 123
Spring seed from early districts . ii. 128
Stack-heating . . . . ii. 200
Stooks . . . . . ii. 188
Storing *v.* immediate selling of . ii. 95
Straw . . . . . ii. 102
Summer culture of . . . ii. 128
Tillage for spring . . . . ii. 120
Time to cut . . . . . ii. 188
Time for sowing in autumn . . ii. 118
Top-dressing . . . . ii. 130
Turning pickled . . . . ii. 131
Two-hand sowing . . . . ii. 122
Under-drainage *v.* water-furrows . ii. 127
Varieties of spring . . . ii. 127
Variety to sow . . . . ii. 118
Varying with soil . . . ii. 94
Vilmorin's classification of . . ii. 93
Water-courses . . . . ii. 118
" furrows . . . . ii. 126
Weight of . . . . . ii. 94
Where to begin sowing . . ii. 121
Width of drill . . . . ii. 124
Yellow rust of . . . . ii. 415
Yield of . . . . . ii. 90
Wheels on ploughs . . . . i. 374
Whin . . . . . ii. 376
" hedges . . . . . i. 105
Whin-bruiser, hand . . . . iii. 320
Whins (furze or gorse) as winter food . iii. 283
Whippletrees . . . . . i. 375
White clover . . . . . ii. 243
" campion seed of . . ii. 74
" variety of . . . ii. 376
Whitsunday entry to farms . . i. 277
Wickets for foot-passengers . . i. 120
Wild white cattle . . . . iii. 4
Wilkie's plough . . . . . i. 382
Wiltshire sheep . . . . . iii. 204
Wind engines . . . . . i. 432
Winding-pillar for wire field-fences . i. 111
Windlass for chain cleaning drains . i. 73
" steam plough . . . . i. 427
Windmills, trials of, in England . . i. 432
Windows—
Hit-and-miss . . . . i. 168
In byres . . . . . i. 157
Specification for . . i. 231, 235, 240, 242
Stable . . . . . i. 167
Winds—
Moist and dry . . . . i. 27
Prevailing . . . . . i. 29
In spring . . . . . ii. 58
Variable . . . . . i. 29
Winnowers, modern . . . . ii. 224
Winnowing, threshing and, corn . ii. 222
Winter . . . . . ii. 66
Attention to ewes in . . . ii. 67
Autumn and, ploughing for turnips ii. 329
" weather for wheat . ii. 13
Beneficial influence of frost . . ii. 68
Best season for draining . . ii. 66
Carting manure in . . . ii. 67
Domestic enjoyment . . . ii. 68
Fattening cattle in . . . iii. 363
Feeding of horses . . . . iii. 318
Feeding stock in . . . . ii. 67
Field work in . . . . ii. 66
Hoar-frost . . . . . ii. 69
Hospitality . . . . . ii. 67
Housing of store cattle . . iii. 357
Implements used in . . . ii. 67
Injury by hoar-frost . . . ii. 69
Irrigation in . . . . . ii. 66
Marketing grain . . . . ii. 67
Planting hedges . . . . ii. 66
Plants uprooted by frost . . ii. 68
Ploughing lea in . . . . ii. 66
Rain . . . . . ii. 68
Recreation . . . . . ii. 67
Sheep in . . . . . iii. 390
Sheep on turnips . . . . ii. 67
Snow, keeps land warm . . ii. 69
" -water and rain . . . ii. 69
Threshing grain in . . . ii. 67
Uses and drawbacks of snow . ii. 69
Vetches . . . . . ii. 368
Water channels in ploughed land . ii. 66
Weather in . . . . . ii. 68
Weather and field operations in . ii. 66
Work in the steading . . . ii. 66
Wintering hill ponies . . . . iii. 47
" young horses . . . iii. 315
Wire fences . . . . . i. 110
Barb- . . . . . i. 113
Charring posts . . . . i. 112
"Corrimony" . . . . . i. 115
Durability of . . . . . i. 114
Erecting . . . . . i. 113
Folding hurdle . . . . i. 116
For game . . . . . i. 116
Intermediate posts . . . i. 111
Iron standards . . . . i. 112
" strainers . . . . i. 111
Knotting wire . . . . i. 114
Number of wires . . . . i. 113
Ornamental . . . . . i. 116
Standard for barb-wire . . i. 113
Straightening wire . . . . i. 114

Wire fences—
Straining-posts . . . . . i. 110
" wire . . . . . i. 113
Varieties of . . . . . i. 112, 114
Winding-pillars . . . . i. 111
Wire-strainer . . . . . i. 113
Wireworms . . . . . iii. 453
" false . . . . . ii. 470
Woad farming . . . . . ii. 403
Woburn experiments with manures, &c. ii. 42
Wood, specific gravity of . . . . i. 24
Wood-mouse . . . . . ii. 427
" snail . . . . . ii. 472
Wooden riddles . . . . . ii. 225
" silos . . . . . ii. 290
Wood-pigeon, the . . . . . ii. 434
Wood's new century reaper and binder ii. 180
Wool—
British . . . . . iii. 404
Classification of . . . . . iii. 405
Irish sheep and . . . . . iii. 407
Long-wooled breeds . . . . iii. 406
Mountain breeds . . . . . iii. 407
Shears . . . . . iii. 385
Short-wool breeds . . . . iii. 406
Storing . . . . . iii. 385
Workers, duties of field- . . . . i. 9
Workmen's Compensation Act, 1906 . i. 296

Xerophytes . . . . . i. 316

Yarrow, seed of . . . . . ii. 79
Yellowhammer, the . . . . . ii. 438
Yield of crops—
Cabbages . . . . . ii. 372
Barley . . . . i. 326; ii. 90, 97, 133
" straw . . . . . i. 326
Beans . . . . . i. 326
Bean straw . . . . . i. 326
Hay, clover . . . . . i. 326
" meadow . . . . . i. 326
Mangels . . . . . i. 326; ii. 366
Mangel tops . . . . . i. 326
Meal . . . . . ii. 100
Oats . . . . . i. 326; ii. 90, 99
Oat straw . . . . . i. 326
Potatoes . . . . . i. 326; ii. 229
Rye . . . . . ii. 101
" straw . . . . . ii. 104
Turnips . . . . i. 326; ii. 325, 327
Turnip tops . . . . . i. 326
Wheat . . . . . i. 326; ii. 90
Yokes, plough . . . . . i. 375
Yorkshire cheese . . . . . ii. 513
" coach horse . . . . . iii. 33
" fog, seed of . . . . . ii. 83
" trials in manuring barley . . ii. 135

Zinc dishes unsuitable for milk . . ii. 488
Zones, the . . . . . i. 261
" of vegetation . . . . . i. 316
Zoology . . . . . i. 15
" economic . . . . . i. 15
" mammals in relation to Agriculture ii. 424

THE END.

PRINTED BY WILLIAM BLACKWOOD AND SONS.